PATTERNS OF RESOURCE USE AND CROSS-CULTURAL DIETARY CHANGE IN THE SPANISH COLONIAL PERIOD

By

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A DISSERTATION PRESENTED TO THE GRADUATE COUNCIL
OF THE UNIVERSITY OF FLORIDA
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE
DEGREE OF DOCTOR OF PHILOSOPHY

UNIVERSITY OF FLORIDA

1975

ACKNOWLEDGMENTS

Throughout the course of this research I have received help and advice from numerous groups and individuals. John Clauser, Bruce Council, Kathleen Deagan, Judith Ansley McMurray, the Historic St Augustine Preservation Board, and the St. Augustine chapter of the Colonial Dames graciously lent me faunal materials and supportive documentation for materials excavated by them or under their care. Robert Steinbach of the NSAPH gave me advice and lent me documentary materials relating to 18th century St. Augustine.

The staff of the P. K. Yonge Library of Florida History gave me invaluable assistance in researching maps and early Spanish documents from their extensive collections. Daniel J.J. Ross took time out from his own research to translate the inventory which appears here as Appendix A. The staff of the St. Augustine Historical Society Library provided help in locating biographical details of 18th century St. Augustine residents and references to foodstuffs in their files. Hale Smith of Florida State University has been working on research similar to my own and very kindly lent me unpublished material on the introduction of plants and animals to Florida. Renato Kimsli of the Smithsonian Institution and the Museo del Hombre Dominicano guided me to historical documents on the Caribbean fauna, and Elpidia Ortega of the Museo brought me up to date on his excavations at the Convento de San Francisco. Lewis Binford, Ivor Noël Hume, and Stan South have given welcome help on specific areas of my data analysis.

A number of [illegible] in the [illegible]tute Museum have greatly facilitated my research over the last few years. J. C. Dickinson, Jr., William H. Maples, and John William Hardy have been instrumental in providing me with office space and financial support, and have given advice in their own fields of expertise. Walter Auffenberg, Carter Gilbert, and Fred Thompson have identified specimens for me and gives me the benefit of their researches into habitat and distribution of herps, fishes, and molluscs. Pierce Brodkorb helped me out on the identification of difficult bird bones. Steve Humphrey and Craig Shaak helped me with diversity indices and problems of sample size. Nancy Halliday gave me help and advice on illustrations, and Kay Purinton photographed the bones. David Hall of the University of Florida's IFAS Herbarium identified plant materials and checked taxonomy and spelling of the Old World cultivated plants. R. B. Hunker of IFAS has done pioneer work on mineral deficiencies in livestock and helped me frame these effects on archeologically recovered bones.

Sharron Tracy Cumbaa drew the maps and life zone cross-sections. Joyce Bryan Lottsville drew the energy flow diagram and Lynn Cunningham the seasonal distribution of fishes. Greg Cunningham helped in the sorting, counting, and weighing of bone from the St. Augustine sites.

Fellow graduate students Rochelle Marrinan, Kass Byrd, and Kathie Johnson critically read initial drafts of the manuscript and made helpful changes and suggestions. Rochelle Marrinan and Lynn Cunningham did a lot of legwork and the final editorial tasks in my absence and for which I am especially grateful. Lydia Deakin has been of invaluable assistance.

numerous times, helping out with administrativ[illegible] deadline dates, facilitating payroll transfers, and numerous other details. My typist and editor, Rhoda Rybak, has always cheerfully put in extra time and effort and put up with my constant flirtations with deadline dates.

Members of my doctoral committee have been of considerable help over the last few years and have been patient with me through these last months of writing and editing. Charles Fairbanks has taught me anthropological archeology and the value of a sound methodology. Jerald Milanich has been of great help on the subject of Spanish-Indian relations and with his infectious enthusiasm for anthropology. Samuel Snedaker has made me aware of man's place as only one of the functional components in a much larger natural system, and David Webb has given me an evolutionary perspective on man-animal interactions. Elizabeth Wing has taught me zooarcheology, has always been available for counsel and advice, and has seen to it that I had laboratory space and some form of employment in which I could work and learn. For all these things I am deeply appreciative.

A final debt of financial and moral support is to my wife, Sharron, and to my parents, Bill and Carolyn Cushas. Their collective perseverance and willingness to help out have been unflagging, and for this I can only offer my sincere thanks. Throughout the course of this research I have been supported by graduate research assistantships in the Natural Sciences and Social Sciences departments of the Florida State Museum, and by graduate teaching assistantships in the University of Florida's Department of Anthropology.

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Abstract of [illegible] presented to the Graduate Council
of the University [illegible] in Partial Fulfillment of the Requirements
[illegible] Degree of Doctor of Philosophy

PATTERNS OF RESOURCE USE AND CROSS-CULTURAL DIETARY
CHANGE IN THE SPANISH COLONIAL PERIOD

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Research into the subsistence system of Spanish colonists in the circum-Caribbean area in the late 15th-mid-18th centuries has shown the importance of natural and cultural environmental factors in the formation of the New World Spanish diet. Zooarcheological analysis of archeologically recovered materials, in combination with documentary research, revealed changes in Old World agricultural crops and techniques, animal husbandry, hunting, fishing, food prices and availability, and cooking and food preparation techniques as the colonists adjusted to New World conditions.

Data on the pre-contact foodways of Old World Spanish and New World aboriginal populations were gathered so that deviations from these patterns could be quantified. The analysis showed that natural factors, primarily the inability of the major Old World crops to thrive and the success of Old World livestock species were tempered by a cultural one mechanism resulting in the addition of New World aboriginal domestic

plant and wild animal food to the colonists' diet. The acculturative process operating was largely one defined as fusion, blending of items from two cultures into a third, unique and adaptive tradition. Food "behavior" is thus seen as a point of articulation between cultural and non-cultural, or natural systems.

New methods of explication and analysis presented in this study are in the use of energy flow diagrams, the effects on animal bone of nutritional factors, and in comparison of standard zooarchaeological techniques.

Introduction

Anyone who has ever lunched on tacos at a local Mexican-style eatery has experienced part of the diverse (and very diffuse) nature of Spanish-aboriginal acculturation in the New World. Contemporary Hispanic American culture is without question a blend of traditions, and nowhere is this mosaic more evident than in food and food preparation techniques. This distinctive blend of spicy foods has in fact become its own tradition, one based on combinations and experiments that began nearly 500 years ago.

This study is an examination of the context and role of acculturation and resource utilization in the origin of the Hispanic American dietary tradition. The focus is first on Spain, then on the Caribbean area, and finally on Florida. Time depth of this study is from the late 15th century to about the middle of the 18th century. In Florida this encompasses the 1st Spanish period, which lasts until the British takeover in 1763.

Hard evidence of the specific nature of the dietary aspect of cultural exchange requires archeological confirmation of written documents and journals. Furthermore, the expansion of Historical Archeology and its unique methodology and techniques serves not only to confirm but to supplement the written record, especially in filling in the day-to-day activities of individuals often lost in the large scale overview which characterizes most histories.

Archeological excavations by the University of Florida and Florida State University in late 1st Spanish period contexts in St. Augustine, Florida, provided the impetus for this study. Recovery of large quantities of faunal remains resulted both from the use of relatively fine-mesh standard archeological screening techniques and from the philosophical viewpoint behind the excavation strategy. In 1972 Charles Fairbanks called for an emphasis on "backyard archeology" which would shift the major purpose of excavations from delineating architectural features to a greater recovery of information on the daily lives of the structure's inhabitants. St. Augustine seemed a good test case since records existed of backyard wells, gardens, patios, outbuildings, and presumably trash pits. That this backyard program proved successful has been demonstrated by Kathleen Deagan in her report on the Maria de la Cruz house site (Deagan 1974).

Subsequent excavations in St. Augustine have added sites which will be discussed later in greater detail. As work proceeded an analysis of the St. Augustine materials, it became clear that there were inter-site dietary pattern differences, as well as still greater disparities between Spanish and Indian occupation sites within the same northeast Florida coastal environment.

The differences and similarities in food procurement and preparation clearly merited further study and it stimulated the investigation of the resource use and diet of peninsular Spaniards. This was done through examination of historic documents and journals. Archeological materials from two Caribbean sites were also available for study and were deemed

pertinent since Spanish culture in Florida had in a real sense been filtered through the peninsulares' experiences in the Caribbean islands.

These experiences had been mostly at the expense of the native peoples of the Caribbean and Central America as Las Casas (1906) and other witnesses so vividly described at the time (see Crosby 1972, Sauer 1966). Columbus' return to Spain in March, 1493, had created a sensation as he presented to the court a few northern Arawak (Taino) aborigines, samples of gold, some artifacts, and Indian corn, although not the wealth of spices the crown had perhaps hoped for. If the excitement of discovery and the prospect of wealth were not enough to ensure future voyages by Columbus and others, Pope Alexander VI issued a series of papal bulls at Spanish request, authorizing, among other things, Spain's title to the discoveries made by Columbus, specifically for the propagation of the Catholic faith (Gibson 1966:15, Sauer 1966 35). The fate of the Americas was sealed as the Spaniards now rushed to the New World (Las Indias) with the dual incentive "for God and country."

The native peoples found by Columbus and later Spanish explorers in what was to become known as the Americas were varied in physical appearance, language, and culture. Some groups lived in temporary brush houses and subsisted on wild foods obtained by hunting, gathering, and fishing, others lived in large cities of stone comparable to those in Europe, had evolved a complex social hierarchy, and were supported almost completely by domesticated plants raised with intensive farming techniques. The aborigines of Florida and the Caribbean were somewhere in between, agricultural peoples who supplemented their diet by hunting, gathering, and fishing

[illegible] could not be easily categorized, neither could the conquest and colonization efforts of the Spanish be fit simply into a pattern. Although the colonizing culture brought with it homogenous elements and strove for uniformity under Spanish rule (Zavala 1943:63), the particular nature of the individual colonization efforts or enterprises was dependent on climate, soils, resource availability, and the aboriginal inhabitants.

Archeological Situations

One of the first, and certainly the most intensive sites of Spanish colonization in the late 15th and early 16th centuries was the city of Santa Domingo on the south coast of the Island of Hispaniola in the present-day Dominican Republic (see Fig. 1). Excavations in 1954 by the late John M. Goggin of the University of Florida, Rafael Montas of the Museo Nacional de la Republica Dominicana, and Emil de Boyrie Moya of the Instituto de Investigaciones Antropologicas de la Universidad de Santo Domingo at the Convento de San Francisco in the old city provided a large sample of faunal materials and the opportunity to note changes in diet through time at this locality from the 16th century to the mid-18th century.

An equally large sample, and the only previously reported Spanish colonial dietary study in the Caribbean area, came from the site of Nueva Cadiz on Cubagua Island off the northeast coast of Venezuela. The Nueva Cadiz materials, excavated by John Goggin of the University of Florida and José M. Cruxent of the Museo de Ciencias Naturales, Caracas, in 1954, represent animal remains from mid-16th century Spanish house and midden debris and were analyzed by Elizabeth S. Wing of the Florida State Museum (1961).

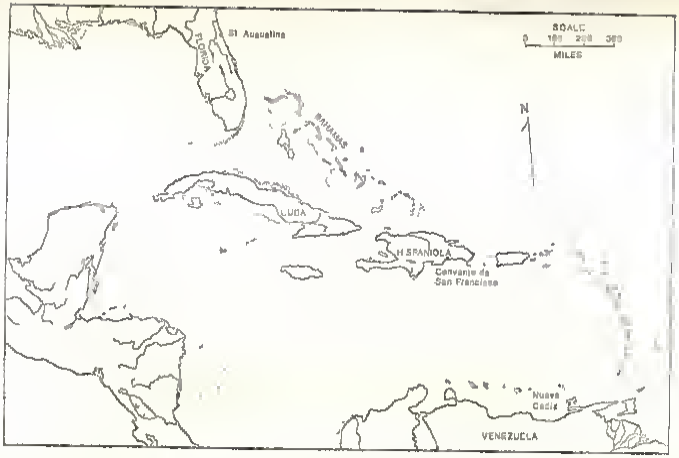

FIGURE 1 Circum-Caribbean area showing major sites studied.

[redacted]-Caribbean Spanish site to incorporate maximum recovery of faunal materials as part of the research design was conducted in 1972 by Charles H. Fairbanks of the University of Florida at the Maria de la Cruz house site, St. Augustine, Florida, in cooperation with the Historic St. Augustine Preservation Board. This same site was further excavated by a University of Florida crew in 1973 under the direction of Kathleen A. Deagan and produced a good sample of precisely dated faunal remains from the mid-18th century.

Additional faunal materials from St. Augustine became available as a result of excavations conducted for the Colonial Dames by the University of Florida under the direction of John W. Clauser, Jr., at the Ximenez-Fatio house site. This site produced a wealth of material from the 1st and 2nd Spanish periods and the short, intervening British period. Only the earlier material is analyzed and presented here.

A smaller sample of faunal materials from a third, mid-18th century, St. Augustine site, the Acosta house, became available in 1974 as a result of a continuing series of cooperative excavations between the Historic St. Augustine Preservation Board and Florida State University, under the direction of Kathleen A. Deagan of Florida State University. Animal bones from the three St. Augustine sites offered particular promise for analysis as they represented three distinct, contemporaneous ethnic-social groups occupying the same environment. In addition, excavation strategies and recovery techniques were similar enough so that data from the sites are directly comparable.

Documentary Research

Certainly the basic premise of historical archaeology would tell us that the best information on the individual sites of colonization is gleaned from a combination of documentary research and archeological excavation. Documentary research covered a number of primary and secondary sources. The chapter on Spain benefitted most from traveler's accounts, primarily Joseph Townsend's A Journey Through Spain in the Years 1786 and 1787, Catherine D'Aulnoy's 1691 Travels into Spain, George Glas' 1764 A Description of the Canary Islands, and Washington Irving's Journal. Comic relief and valuable data were combined in novel form in Cervantes' Don Quixote de la Mancha, originally written in 1605 with a second part added in 1615. The Spanish economist, Jaime Vicens Vives, analyzed much useful data in his An Economic History of Spain. George Foster's Culture and Conquest: America's Spanish Heritage was invaluable as a starting point and source of ideas and references.

Contemporary historical studies of the Spanish in the Caribbean by Samuel E. Morison and Carl O. Sauer aided greatly in analysis, translation, and compilation. Of particular help were Morison's Journals and Other Documents on the Life and Voyages of Christopher Columbus and Sauer's The Early Spanish Main. Other valuable standard sources included the works of Las Casas, Oviedo's Natural History of the West Indies, Vasquez de Espinosa's Description of the Indies, and Esquemeling's The Buccaneers of America.

Research on Florida was facilitated greatly by the collections of the P.K. Yonge Memorial Library of Florida History, including the Stetson Collection of photostats from the Archivo General de Indias (hereinafter

referred to [illegible] in [illegible] Jeannette Thurber Connor's Colonial Records of Spanish Florida, largely translated from the Archives of the Indies, was extremely helpful However, as my interest in Florida was concentrated on the mid-18th century, research was largely in more readily available sources such as John Bartram's Diary, Mark Catesby's The Natural History of Carolina, Florida and the Bahama Islands, De Brahe's Report, Romans' Natural History of Florida; and excellent contemporary studies by Charles W Arnade, Verne E Chatelain, Lois Armas, and Brian George Boniface Lewis C Gray's History of Agriculture in the Southern United States to 1860, Hale G Smith's manuscript Some Factors Leading to an Ecological Change in Florida from A D 1512-1821, and especially Alfred W Crosby, Jr 's The Columbian Exchange Biological and Cultural Consequences of 1492 provided valuable synthesis and stimulation

Goals and Methodology

It was assumed at the beginning of this research that Old World Spanish foodways could be characterized, and furthermore, that due to major differences in cultural heritage and environment, that these foodways would differ significantly from those of the native peoples of the circum-Caribbean area Foodways is here used as a term describing the selected transfer, acceptance, use, and preparation of various foodstuffs by a people of common cultural heritage The research objective was then to describe the pre-contact resource use and dietary pattern of both groups, and using archeological sites as examples, to document changes in the subsistence base of the Spaniards and aborigines in the New World after contact, and to account for those changes

[illegible] of Augustine [illegible] sion of other Spanish and Spanish-Indian sites in Florida, [illegible] contemporary research the basis of comparison between the dietary patterns of Old and New World Spaniards. Coupled with previous studies of aboriginal diet, this approach allows insight into the process of acculturation through types of food resources used, methods of food procurement, production, and preparation, and the place of subsistence activities as part of a group's total material culture. Based on Old World Spanish foodways, specific testable implications will be outlined to aid in evaluation of the interplay of cultural-ecological factors in the New World diet. In studying only a part of the total cultural interaction between Spanish and Indians, that of foods, references to the "donor" and "recipient" cultures (Foster 1960:11) become subject to a degree of quantification.

One of the purposes and values of this work is its contribution to the data base and methodology of Zooarchaeology and in a broader sense, Archeology. Various standard methods of analysis of animal bones (see Ziegler 1973) have been employed on the same specimens, and the results compared so that we may be more aware of the biases present in any single method of quantification and analysis. New directions are indicated in analysis of historic site materials based on work in animal nutrition, and ecological measures of species diversity are applied as a tool in inter-site comparison (see Appendix B).

Application of concepts familiar to systems ecologists is growing in Anthropology, particularly of work pioneered by Howard T. Odum (1971). Odum's energy flow diagrams are being incorporated in contemporary ethnographic studies to show relationships between component parts of living

systems in wh[illegible] parts of larger ecosystems. Energy flow diagrams, first used in an archaeological context by Elizabeth S. Wing (1973a) in the study of a prehistoric herding economy in the Andes, are here employed for the first time in the study of an historic community. By employing written records as substitutes for poorly-preserved or missing plant foods, better control is available for this important sector of the subsistence economy.

I hasten to add that this study is by no means an attempt to document all Old and New World foodstuffs used by the Spanish and Indians; rather, it is a study of the types of food characteristic of the "cultural baggage" of these groups, and to paraphrase Flannery (1967:119), of human food "behavior" as a point of articulation between systems of cultural and non-cultural phenomena. Before moving to the New World and examining this behavior, we need to look first to the Iberian peninsula for the food traditions carried to the Americas by several generations of conquistadors and colonists.

CHAPTER 2

[illegible] FOOD ECONOMY IN THE OLD WORLD

Historical Background

The study of the nature and process of Spanish-aboriginal acculturation in the New World requires consideration of historical antecedents, and we cannot adequately discuss the food history of medieval Spain without at least passing mention of the Moorish influence. Berber and Arab armies respectively had entered Visigothic Spain from northern Africa by the 8th century, developing a stronghold on the more temperate, fertile southern half of the peninsula early in the 10th century. By this time Moslem rule under the Caliphate of Córdoba was established in Andalusia, and the economy flourished. The key was the establishment by the Moors of large-scale irrigation utilizing forced labor which aided the production of traditional Iberian food crops such as wheat, olives, and grapes, and allowed the introduction of subtropical luxury crops such as citrus, sugar, saffron, mulberries and cotton (Parry 1966:29).

Unified control of the southern part of the peninsula came to an end after a little over 100 years when the Caliphate broke up into 20-30 taifas--feudal states loaded around principal cities with no strong central ties or allegiances. This made it easier to attempt the reconquest, and Moorish and Christian forces battled for control of the individual taifas for two centuries.

It is [illegible] that the region of the Iberian peninsula which proved unattractive to the Moors of previous centuries should be the one which played the greatest hand in the Moorish expulsion in the 13th century. Castile, undesirable due to its thin soil and arid climate, had the only predominantly pastoral economy in Western Europe (Parry 1966:31). This economy was based on the seasonal transhumance of immense flocks of sheep from northern mountain pastures in the summer to more lush southern lowland vegetation in the winter, and smaller local movements of herds of pigs and cattle. This seasonal transhumance was so important to the maintenance of the Castilian economy that it became an added stimulus to drive out the Moors who had frequently blocked access to the southern pastures (Tannahill 1973:206-7).

After the fall of Seville in 1248, Andalusia began to be heavily populated by colonists from harsher climates all over the peninsula (Parry 1966:33). Moorish fruits, crops, and agricultural techniques remained to benefit the new population, which was a mixture of Castilian Catholics, Jews, and Moriscos, or converted Moslems who were the principal agricultural workers. With Seville the Castilians also gained an established port, already busy with the African trade.

With the impetus of success the Iberian kingdoms of Castile and Aragon were developing into states, a process which culminated in the marriage of Ferdinand of Aragon and Isabella of Castile. This political coalition under the leadership of Isabella engineered the final expulsion of the Moors from Granada, a Moslem enclave which had remained for 200 years after the other taifas had been defeated. This last of the Holy Wars began in 1482 with a

systematic plan for the conquest of the Moorish kingdom village by village. The process took 10 years of fighting, and in 1492 the 800-year reconquista was concluded.

Although the origin of the Spanish state can be traced to the marriage of Ferdinand and Isabella in 1469, it was not until the final expulsion of the Moors from Granada in 1492 that they could take the time to adequately pursue rapidly burgeoning international interests. Chief among these was intense rivalry with the Portugese in attempts to enter into the lucrative spice trade. Venice capitalized on the expulsion of the Moslems from the areas surrounding the Holy Land during the Crusades to establish a monopoly on overland trade routes to Egypt, India and the Asian spice islands, and established autocratic control over European commerce and the spice market. The Portugese under Henry the Navigator and his successors were seeking a sea route to India to counteract the Italian advantage, and in the process had discovered in Africa a great source of gold, ivory and slaves in addition to some spices.

Although latecomers, the Spanish had, in the last quarter of the 15th century, managed to subdue the aboriginal inhabitants of the Canary Islands and establish this geographically important island group as a staging area for further voyages of exploration (Abreu de Galineo 1764, Gibson 1966:5). One author has remarked that in the Canaries the Spaniards had their first experiences in conquering, converting and exploiting a more technologically primitive people, thus serving their first apprenticeship in "... the arts of colonial empire ..." (Parry 1966:42). However, the expulsion of the Moors from Granada gave the Spanish experience in taking over a feudal

system and led to the development of adelantismo, a system of provincial governorship which was used in parts of the New World

In addition to these growing external pressures and conflicts which included constant vigilance of the Moslems in North Africa, Spain had internal problems resulting from unsound agricultural practices. The reign of Ferdinand and Isabella was marked by famine in Castile. This condition was worsened by laws disallowing fenced agricultural fields in order to promote free access to pasturage by the transhumant flocks. Establishment of these sheepwalks benefitted the crown through a livestock tax and favored the nobles who were able to control the movement of the herds and at the same time add to their growing latifundia, or large estates, through carefully designed legal provisions (Vicens Vives 1969:302). Control of the migrations of large and small herds alike was vested in a powerful political organization known as the Mesta, and through this organization, monopolistic regulation of the wool trade was achieved. It would seem that the agricultural priorities of Ferdinand and Isabella can be traced in part to the monarchs' origins in the upland heart of Spain's livestock district and insensitivity to the needs of the farmers whose crops were being destroyed by the transhumant herds.

By 1504 the inequitable structure of agrarian policy favoring livestock and latifundia resulted in a grain crisis, and by 1505 massive importation of wheat was necessary (Vicens Vives 1969 304). This compounded problems in production caused by the earlier forced expulsion or conversion in 1492 of Jews and Moslems. These groups, who had been primarily traders and farmers, were forced out as a direct result of the establishment in the 1480's of the new Inquisition which had further diverted the energies of the populace

By [illegible] the Moors had been driven out of Granada, the aboriginal population of the Canaries had been subdued and the islands readied for the provisioning and refitting of ships. There were rumbles of an inadequate food supply and Ferdinand and Isabella were ready to move into world commerce and the spice trade. The technical ability for long ocean voyages across tradewinds had been developed by the Portugese in navigation and advances in ship construction, exemplified by the relatively swift caravels with three masts and a lateen sail with a movable spar (Sauer 1966 10). In short, the stage was set for the Genoese navigator Columbus who had sailed to Africa at least once with the Portugese to propose his "enterprise of the Indies."

We need not dwell here on the rest of this well known history in any detail. Columbus' proposal was accepted by the crown, he gathered ships, men, and supplies in the Andalusian ports on the Atlantic coast and sailed from Palos for the Canaries. After a four week stay to refit the ships and take on wood, water, and meat, the Nina, Pinta, and the Santa Maria caught the northeast trade winds and 33 days later, October 12, 1492, landed on one of the islands in the Bahama group which they named San Salvador (Morison 1963 48-54). The Columbian Exchange (Crosby 1972) had begun.

The next several decades were marked by intensive efforts in the discovery and colonization of the New World, with the resultant introduction of several new foods to the Spanish larder. It is at this time that a picture of Old World 16th-18th century Spanish food ways begins to emerge, at a time when traditional foods are being supplemented, but not necessarily supplanted by spices, fruits, vegetables, and root crops from the New World, Asia, and Africa.

To reconstruct the [illegible] World Scenario did in lieu of archeological evidence requires rather meticulous search through a variety of printed sources and manuscripts. This approach involves a number of problems. Chief among these is that in pre-Columbian Spain printed books were scarce and the printing presses reserved for incunabulae of greater note than discussions of temporal agricultural practices or eating habits. A hundred years later conditions had changed and authors were decrying the proliferation of spurious editions of their better works. Even so we are forced to pick bits of information from casual descriptions in early novels and traveler's journals, often written well into the colonial period when New World, Asian and African cultigens and imports were common in Spain.

Fortunately there are few remaining significant questions of biological origins pertinent to this question, and even if not so designated in the original sources, indigenous plants and animals can be separated from exotic species with reasonable certainty. From these early reports we can gain insight into the social and economic position of certain foodstuffs, and can note the progress of experimentation with foods from afar as they filtered through socio-economic classes.

Word usage and connotation has certainly changed through the years, and it is easy to misinterpret what would seem to be quite literal meanings. For instance, "corn" may refer to wheat, rye, or barley; only later is the word used to refer to maize. "We struck a bargain with them for a cargo of wheat, for one of the vessels, for at that time I and two in the bay, one of which I intended should carry this corn to the island of Madeira" (Glas 1764 211 [emphasis mine]). In these earlier sources "maize" or "Indian corn" is generally used to refer specifically to Zea mays, although Sauer (1963 22) mentions that the oldest Spanish name for maize is panizo

There was also some early confusion of terms and descriptions involving maize, sorghum, and millet in the early 16th century (Sauer 1963:23-25).

Confusion in terminology is not restricted to maize. The term "cattle" (ganado in Spanish), which now refers generally to members of the genus Bos and in some parts of the world to the various genera of buffalo, often was a general term for livestock. One 18th century traveler noted that "The cattle of those islands are camels, horses, asses, bullocks, sheep, goats, and hogs . . ." (Glas 1764 197). "Fowls" most often refers to chickens (Gallus gallus) but may include ducks, geese, turkeys (the latter an introduction from the New World), or other domestic birds. Another example would be the distinction between "rabbit" and "hare," the former referring to the domestic form.

Quantitative descriptions of fields and crop yields are hazardous due to the number of local names for measures of volume and the generally imprecise nature of linear and volume measures alike. Foster (1960:57) has simplified this problem somewhat by listing contemporary equivalents; the Castilian yard or "vara" equals 0.836 meters on the average, but the more traditional land measure is by area in varas squared and called the fanega, generally equivalent to .64 hectares. Caution should be exercised though as one English traveler related that a fanega is equivalent to 10,000 square feet (Townsend 1814, II:54) which would be roughly one-seventh Foster's measure. A fanega may be divided into 12 celemines which can be quartered to become cuartillos, or the equivalent in English measure of a 35' x 40' garden plot if we use Foster's values. A fanega may also be used as a volumetric equivalent for the amount of seed needed to plant a fanega of land.

the amount Foster lists for wheat is about 55 li[illegible]s (1960 57) [illegible] measure, the arroba, appears to be the most trustworthy and is generally calculated as 25 pounds

In spite of the problems in measure and nomenclature, a thread of consistency runs through descriptions of agricultural practices and products, prices, and foods and food preparation techniques in Hapsburg and Bourbon Spain Georgs Foster (1952, 1960) has indicated the need to study all parts of Spain for antecedents to Hispanic American cultural elements, not just the southern and western sections, since nearly all parts of the country supplied significant numbers of emigrants to the New World. The pattern of this basic dietary stability and differential acceptance of new foodstuffs enables us to generate predictive models of resource utilization and dietary change of the Spanish colonists in the New World

Agricultural Crops and Techniques

The enrichment by the Moors of Spanish agricultural crops and techniques, particularly the concept and practice of large-scale irrigation with its potential for new crops and higher yields from traditional ones has been noted earlier (Parry 1966 29; 1960 50) Spanish farmers continued to use the Roman, or Mediterranean scratch plow with regularity throughout the 16th century (Vicens Vives 1969:506, Foster 1960 50) The aptly-named scratch plow, often ox-drawn, has no moldboard to turn the soil and consequently requires cross-plowing This resulted in generally square-shaped fields rather than the characteristically cleared rectangular strips made by the ox-drawn moldboard plows of Northern Europe (Foster 1960 58) An early significant agricultural development, but one which failed to take hold in

Spain, was the invention of [illegible] by the [illegible] century, and the accompanying innovation of the three-field crop rotation system (Tannahill 1973:192).

More significant than the low efficiency of the scratch plow was the use throughout Spain of the two-field system of crop rotation which left half of the agricultural land fallow each season. The advantage of the three-field system was that a given plot of land would be productive two years out of three instead of one out of two by alternating grain crops, legumes, and fallow periods.

Fields were enriched through crop rotation, fallow periods, and occasional minor inputs through slash and burn techniques (Foster 1960:59), but generally through animal feces. A dual purpose was usually achieved by feeding sheep or cattle on stubble from a cleared field, often by a *tumbo de red*--enclosing the flocks overnight by means of a portable net wall which was then moved to another sector of the field (Foster 1960:57).

Other than locust plagues, the most serious hindrances to agriculture in the relatively fertile southern half of the Iberian peninsula were the legal sanctions given to livestock owners (Vicens Vives 1969:302). The seasonal movements of the massive flocks, particularly of sheep, restricted both the location and the size of agricultural fields. Although data are lacking, it would seem that a system which occupied three-fourths of the available agricultural land in the 18th century under a one-crop system of cereal grains (Vicens Vives 1969:511) would be a prime target for attack by monocrop pathogens. Perhaps the exigencies of small field size and scattered location to accommodate transhumant flocks was a limiting factor

to disease spread, but th[illegible] could be ideal vectors. Ar[illegible] to Spanish agricultural productivity was the expulsion in 1609-1611 of the Moriscos, the Muslim converts who were Spain's best agricultural laborers (Vicens Vives 1969:423).

The primary crops in Spain have traditionally been cereal grains--wheat, barley, oats, and rye. Rice had become increasingly important since its introduction by the Moors, but by the mid-18th century, maize, introduced from the New World after Columbus (Sauer 1963:27 disagrees), had become the prime cereal crop (Vicens Vives 1969:511). It is of interest that truly widespread use of maize followed its introduction into Asturias by Gonzalo Mendez de Canzo on his return to Spain in 1604 after serving as Governor of Florida (Vicens Vives 1969:512).

Following the grains in importance were vegetables, the most important being chick peas, lima beans (of New World origin), field peas, and French beans (also a New World cultigen). The potato, introduced to Spain from the Andean region of South America, did not really become a popular food until after 1768 when its systematic cultivation began in Galicia (Vicens Vives 1969:512). Spain's major agricultural export products have for centuries been olive oil and wines, and it can be truly said that they were essential ingredients to Spanish cooking. Oranges, figs, and apples were the most important fruits, with oranges coming into prominence at the end of the 17th century (ibid.).

Table 1 lists the principal Spanish food crops of the 16th-18th centuries, and while it should not be regarded as exhaustive, it does give a good idea of the variety of plant foods available at the time and notes on the type of

cultivation. Origins are [illegible]ly noted for New World crops, but a considerable number of Asian and African species are present as part of the Moorish heritage and the largely post-1500 A.D. direct contact between Spain and the Far East. Table 1 lists nearly 70 species of cultivated plants, but even by the 12th century one Abu Alawam had compiled a list of more than 120 species cultivated near Seville (Vicens Vives 1969:109).

Livestock and Domestic Animals

The previous discussions of Spanish agricultural policies, particularly under Ferdinand and Isabella and the Hapsburgs, should have made clear the fact that sheep have historically been the great source of Spanish animal wealth. Their primary importance, particularly after the development of the Merino breed, was wool production. The live animal was also valuable as a source of milk and cheese. Mutton eating came into greater popularity during the Moorish occupation (Tannahill 1973:287), and even the skin, short of its wool, was valuable for parchment.

If we can equate numbers of animals with relative value, then the suggested importance of sheep is borne out by figures from the first available national census of livestock in 1797, a period when livestock breeding and the influence of the Mesta had been on the decline for nearly a century: 11.7 million sheep, 2.5 million goats, 1.65 million oxen, 1.2 million swine, and 0.23 million horses (Vicens Vives 1969:517). The Spanish government, as an incentive to attract settlers to underpopulated areas in the Sierras in the late 18th century, offered individual families land up to a maximum of 100 fanegas (measured as 10,000 square feet each), a house, two cows, one ass, five sheep, five goats, six hens, one rooster, and one pregnant sow

Table 1 Principal 16th-18th Ce[illegible]

Species	Common Name: English	Spanish	Source	Cultivation
GRAMINEAE				
Avena sativa	oat	avena	Townsend 1814, I.129	field crop
Hordeum vulgare	barley	cebada	Ibid	field crop
Oryza sativa	rice	arroz	Townsend 1814, II 310	field crop
Panicum miliaceum	millet	mijo, millo	Townsend 1814, I:129	field crop
Saccharum officinarum	sugar cane	caña de azúcar	Irving 1937 7	field crop
Secale cereale	rye	centeno	Townsend 1814, I 129	field crop
Sorghum cf. S. vulgare	sorghum			
Triticum spp	wheat	trigo	Townsend 1814, I:129	field crop
*Zea mays	maize,	maíz, panico	Ibid.	field crop
CYPERACEAE				
Cyperus esculentus	chufa	chufa	Townsend 1814, II 336	fields
PALMACEAE				
Phoenix dactylifera	date palm	palmera	Townsend 1814, II 244	clustered near habitations
BROMELIACEAE				
*Ananas comosus	pineapple	anana	Tannahill 1973 241	garden
LILIACEAE				
Asparagus officinalis	asparagus	espárrago	Kamy 1932 147	garden

Table 1 - Continued

Species	English	Spanish	Source	[illegible]
AMARYLLIDACEAE				
Allium spp.	onion	cebolla	Cervantes 1949-80	garden, field
Allium ampeloprasum	leek	puerro	D'Aulnoy 1930-193	garden, field
Allium sativum	garlic	ajo	Cervantes 1949-659	garden, field
DIOSCOREACEAE				
Dioscorea sp	yam	ñame	Glas 1764-230	garden
IRIDACEAE				
Crocus sativus	saffron	azafrán	Kamy 1932-146	garden
MUSACEAE				
Musa sapientum	banana	banana	Glas 1764-230	garden
(or M. paradisiaca)	plantain	plátano	Sauer 1963-52	garden
FAGACEAE				
Castanea sativa	Spanish or sweet chestnut	castaña	Townsend 1814, I 293	groves
MORACEAE				
Ficus carica	fig	higuera	Townsend 1814, I-129	garden, trees
Morum nigra	black mulberry	mora	Townsend 1814, II-179	groves
CRUCIFERAE				
Brassica oleracea	cabbage	col, berza	Townsend 1814, I-129	garden, field
Brassica oleracea	cauliflower	coliflor	ibid	garden, field

Table 1 -- Continued

Species	Common Name: English	Common Name: Spanish	[illegible]	Cultivation
Brassica oleracea	broccoli	brécol	Kany 1932 147	garden, field
Brassica rapa	turnip	nabo	Townsend 1814, II 310	garden, field
(or B. napobrassica)	rutabaga		ibid.	garden, field
Nasturtium officinale	watercress	berro	Kany 1932 147	ponds
Raphanus sativus	radish		Morison 1963 217	gardens
ROSACEAE				
Cydonia vulgaris	quince	membrillo	Tunnahill 1973:126	garden tree
Malus pumila	wild crabapple	manzana	Townsend 1814, I 293	garden tree, orchards
(or M. sylvestris)	apple		ibid.	garden tree, orchards
Amygdalus communis	almond	almendra	Townsend 1814, I 216	groves, orchards, garden tree
Armeniaca vulgaris	apricot	albaricoque	Townsend 1814, II:284	groves, orchards, garden tree
Prunus domestica	plum	ciruela	Townsend 1814, II 284	garden tree
Prunus persica	peach	melocotón	ibid	garden tree
Prunus persica	nectarine	griñón	ibid	garden tree
Prunus spp.	cherry	cereza	ibid	garden tree
Pyrus communis	pear	pera	Townsend 1814, I 293	individual trees, orchards

Table 1 - Continued

Species	Common name: English	Common name: Spanish	Source	Cultivation
LEGUMINOSAE				
Ceratonia siliqua	carob	algaroba	Cervantes 1949 588	groves, garden tree
Cicer arietinum	chick pea	garbanzo	Cervantes 1949 894	garden, field
Glycyrrhiza glabra	licorice	regaliz, orozuz	Townsend 1814, II 97	field
Lathyrus odoratus	sweet pea	guisante	Townsend 1814, I 129	garden
Lens culinaris	lentil	lenteja	Townsend 1814, II 55	garden, field
*Phaseolus limensis	lima bean	judía de la peladilla	Vicens Vives 1969 512	garden, field
*Phaseolus vulgaris	kidney bean, French bean	judía	Townsend 1814, I 136	garden, field
Pisum arvense	field pea		Sauer 1963 39	garden, field
Vicia spp. (or other genera in the family)	vetch	alverja, arveja,	Townsend 1814, I 136	field
Vicia faba	broadbean	haba	Sauer 1963 39	garden, field
RUTACEA				
Citrus aurantifolia	lime	lima agria	Townsend 1814, II 177	individual trees, groves
Citrus limon	lemon	limón	Townsend 1814, II 97	individual trees, groves
Citrus medica	citron	cidro	Townsend 1814, II 177	individual trees, groves

Table 1 - Continued

Species	Common Name: English	Common Name: Spanish	Source	Cultivation
Citrus sinensis	Sweet orange	naranja	Townsend 1814, I:129	individual trees, groves
VITACEAE				
Vitis vinifera	grape, wine grapes	uva	ibid.	fields, vineyards
CACTACEAE				
*Opuntia spp	prickly pear	higo chumbo	Townsend 1814, II.172	garden
PUNICACEAE				
Punica granatum	pomegranate	granada	Townsend 1814, II 179	garden tree
UMBELLIFERAE				
Daucus carota	carrot	zanahoria	Glas 1764 289	garden
Pastinaca sativa	parsnip	chirivía	Townsend 1814, II·307	garden
OLEACEAE				
Olea europe	olive	aceituna	Cervantes 1949·862	groves
CONVOLVULACEAE				
*Ipomea batatas	sweet potato	batatas	Glas 1764 230	garden, field
SOLANACEAE				
*Capsicum frutescens	bell and chile peppers	chile, pimiento	Townsend 1814, II:306	garden
*Lycopersicon esculentum	tomate	tomate	ibid	garden
*Solanum tuberosum	potato	papa, patata	Glas 1764 230	garden, field

Table 1 - Continued

Species	English	Spanish	Source	Cultivation
CUCURBITACEAE				
Citrullus vulgaris	watermelon	sandía	Vicens Vives 1969 109	garden
Cucumis melo	melon	melón	Townsend 1814, I 293	garden
Cucumis sativus	cucumber	pepino	ibid.	garden
*Cucurbita spp.	squashes (4 var.)	calabaza	Townsend 1814, II 336	garden
*Cucurbita pepo	pumpkin, pompion	calabaza común	Glas 1764=230	garden
COMPOSITAE				
Cynara scolymus	globe artichoke	alcachofa	Townsend 1814, II.310	garden
Lactuca sativa	lettuce	lechuga	Townsend 1814, I=129	garden

* Indicates New World origin

(Townsend 18[illegible], [illegible]). The terms of this typical grant should give [illegible] accurate estimation of the percentage composition and species thought necessary for subsistence and perhaps a small income in the late 18th century. With the exception of sheep, much the same percentage is reflected in the livestock of one large estate in Granada which had 1200 sheep, 400 goats, 158 pigs, and 56 oxen (Townsend 1814, II:179). Other common domestic animals mentioned in the documents and journals included rabbits, dogs, turkeys (a New World domesticant), ducks (possibly New World), geese, doves, pigeons, silkworms, and bees. Silkworms were brought from China along with mulberry trees by the Moors. Bee keeping was apparently very important and somewhat ritualized (Foster 1960 74). Although dogs were generally work animals helping with the flocks, in some areas they were regarded as a source of meat. In Extremadura dogmeat was considered a delicacy (Simoens 1961 102). The camel was locally important as a draft animal in the Canary Islands (Glas 1764 195).

Sheep normally followed a migratory winter-summer pattern, small flocks following large ones along the route of the seasonal trek. The transhumance of cattle was apparently limited since herds were much smaller. Cattle were kept for milk and meat and oxen (castrated males) were the principal draft animals. Both beef and veal animals were occasionally fed algarobas, or carob beans (Townsend 1814, II:40). Goats were of the greatest importance in marginal areas, although they were present all over the peninsula and kept for milk and meat. Mules and hurros were utilitarian animals and horses generally regarded as prestigious (Foster 1960 72), although at times young horses were commonly eaten as "red deer" in Spain and supplied to the

many for food (Simoons 1961 84). Swine were an important source of meat and were acorn fed when possible. They usually remained in the villages but were driven to surrounding grain fields after the harvest and often several miles to good stands of oak trees to feed on acorn mast in the fall (Foster 1960 72)

Hunting

Hunting was at best a marginal activity, reflecting the relative paucity of the modern fauna and the decimation of forest habitats for fuel. The only mammals that appear to have been hunted with any regularity were the rabbit or hare and members of the deer family. Both wild and domestic rabbits (Oryctolagus cuniculus) are present in Spain as are the wild hares (Lepus capensis and L. europaeus). The wild species appear to have been frequently hunted (Townsend 1814, I 165, Cervantes 1949 446, 637) and were, with birds, the most common non-domestic meat source.

Of the three species of deer, the most commonly hunted was probably the red deer (Cervus elaphus) which attains a maximum size of 200 kg, or the fallow deer (Dama dama), introduced during Roman times (Zeuner 1963 430) which reaches a maximum of 85 kg (van den Brink 1972). The roe deer (Capreolus capreolus) at a maximum of 27 kg seems too small to fit the few available descriptions. Nevertheless, by the late 18th century deer were protected under royal decree and were infrequently hunted (Townsend 1814, I 370-71). The only other mammal which seems to have been hunted at least occasionally is the Mediterranean monk seal (Monachus monachus), an animal which was probably uncommon even by the 17th century. Evidence for the the hunting of these seals is slim, and is based on Cervantes' description

of his hero Don [illegible] de la Mancha, and had a sword [illegible] from "sea-wolf's hide" (19-9 621) Lobos marinos was a common early Spanish designation for seals.

Birds seem to have been frequently hunted and although most sources mention the inclusive term "game birds," we do find references to particular species. Partridges were taken by peasants in Andalusia who set out tame partridges to act as decoys (Townsend 1814, II 54). Pheasants were another relished table item (D'Aulnoy 1930 325) from fields and upland areas Coastal birds included "sea fowl," "sea hens," and cormorants. Young cormorants "and other sea fowl" were caught in their nests, killed, salted, and sold in the summer in the Canary Islands (Glas 1764 280).

Fishing

Spanish fishermen undoubtedly learned many fishing techniques from the Portugese following the expulsion of the Moors in the late 15th century. Fishing was not a major aspect of Moslem subsistence economy whereas the Portugese fishermen had been systematically exploiting the Atlantic for years. Inland fishing was restricted to trout from the mountain rivers caught with rod, hook, and line for subsistence rather than as a commercial venture (Townsend 1814, I 279, Cervantes 1949 781). Coastal rivers were commercially fished for salmon (Salmo salar), an anadromous species more easily taken on their river ascent than in the open ocean.

The great bulk of commercial fishing occurred in the Atlantic and the Mediterranean, and we are fortunate to have detailed descriptions of both the fish and the technique for catching them. This has facilitated the compilation of Table 2 which gives the scientific and common names of the various species and habitat information derived from modern sources (Nursau and Monod 1973).

Table 2 Likely 18th Century Spanish Commercial Fishery Species.

Species	Common Name		Source	Habitat
	English	Spanish		
SQUALIDAE				
Squalus acanthias	dogfish	mielga, galludos	Townsend 1814, II-274	soft bottom[illegible] 10-200 m
CLUPEIDAE				
Sardina pilchardus	sardine	sardina	Irving 1937-50	over continental shelf, pelagic, l[illegible]
ENGRAULIDAE				
Engraulis encrasicolus	anchovy	boquerón	Townsend 1814, II-174	pelagic
SALMONIDAE				
Salmo salar	salmon	salmón	D'Aulnoy 1930-221	anadromous
CYPRINIDAE				
Leuciscus vulgaris	dace	albur	Morison 1963-117	freshwater rivers, lakes
MERLUCCIIDAE				
Merluccius merluccius	hake	pijota, merluza	Morison 1963-117	mid-water or [illegible]

Table 2 - Continued

Species	Common Names: English	Common Names: Spanish	Source	Habitat
GADIDAE				
Gadus morhua	cod	bacalao	Townsend 1614, I:285	shore to 600 m, bottom to intermediate depths
SERRANIDAE				
cf. Epinephelus caninus	toothed grouper	mero (Fr)	Glas 1764:198	sublittoral, littoral to 300 m over mud, sa
Epinephelus guaza	grouper	mero	Glas 1764 198	littoral, over rocks 8-200 m
Polyprion americanus	wreck fish, stone bass	cherna	Glas 1764:334	sublittoral, littoral over ronks to 1000 m
POMATOMIDAE				
Pomatomus saltator	bluefish	anjova	Glas 1764 334	pelagic in shallow waters, 10-200 m
CARANGIDAE				
Caranx hippos	crevalle jack	caballa	Glas 1764 334	pelagic
Elagatis bipinnulatus	rainbow runner, pompano		Morison 1963:117	pelagic, occasionally near shore

Table 2 -- Continued

Species	Common Names: English	Common Names: Spanish	Source	Habitat
cf. *Trachurus mediterraneus*	Mediterranean scad	chicharro	Glas 1764:334	pelagic
Trachurus trachurus	horse mackeral	chicharro	Glas 1764:334	pelagic
SCIANIDAE				
Argyrosomus regius	meagre	corvina	Glas 1764:342	neritic, surfzone and mid-waters
Umbrina canariensis			Glas 1764:342	benthic, 50-300 m over sand, mud
Umbrina cirrosa		corvina (Pr)	Glas 1764:342	rocky coastal bottoms
SPARIDAE				
cf. *Pagellus bogaraveo*	red sea bream	besugo	Glas 1764:334	sublittoral, littoral shore to 700 m
SCOMBRIDAE				
Auxis rochei	frigate mackerel	melva	Townsend 1814, II 239	epi- and mesopelagic seasonally coastal
Orcynopsis unicolor		tasarte	Glas 1764:334	epipelagic, relatively coastal

Table 2 - Continued

Species	Common Names: English	Spanish	Source	Habitat
Scomber scombrus	Atlantic mackerel	cavala (Fr)	Glan 1764:334	epipelagic to mesodemersal, to 250 m
cf Thunnus thynnus	bluefin tuna	atun	Townsend 1814, II:239	epi- and mesopelagic seasonally coastal
STROMATEIDAE				
Stromateus fiatola		pámpano	Morisco 1963:117	bottom, 12-50 m
SPHYRAENIDAE				
Sphyraena sphyraena	barracuda	picudo	Glan 1764:198	littoral, above sand
MUGILIDAE				
Chelon labrosus	thick-lipped grey mullet	lisa	Foster 1960:80	neritic, brackish
Liza aurata	golden grey mullet	galupe	Foster 1960:80	coastal, salt or brackish
Mugil cephalus	striped mullet	pardete	Foster 1960:80	epipelagic, brackish

Table 2 - Continued

Species	Common Names: English	Spanish	Source	Habitat
SCOPHTHALMIDAE				
Lepidorhombus spp.	megrim, sealdfish	gallo	Morison 1963:117	benthic
SOLEIDAE				
Solea vulgaris	common sole	lenguado	Morison 1963:114	sand, mud bottoms to 150 m
CHELONIIDAE				
Caretta caretta	loggerhead	tortuga	Olas 1764:212	pelagic
CETACEA	whale	ballena, cachalote	Vicens Vives 1960:522	pelagic

de [illegible] to [illegible] (1[illegible]-2) for the most informative description of fishing by the Spanish on the Barbary coast. According to Glas, each boat would have a crew of 15-30 fishermen, with each man responsible for bringing his own tackle which consisted of lines, hooks, brass wires, a knife, and stout rods. The only provisions supplied by the boat owner were salt and bread, and proceeds from the catch were divided into shares after the sale of the salted fish at the voyage's end. Locations were fished according to seasonal abundance of the various species.

The first step was the catching of rather sizable bait fish by trolling five-inch, unbarbed leaded hooks baited with fish skin. The hooks were attached to the rod by a length of twisted brass wires and trolled one-quarter to one-half mile offshore. The "bait fish" included a species of mackerel (Orcynopsis unicolor), bluefish (Pomatomus saltator), and probably crevalle jack (Caranx hippos) which were caught with smaller hooks baited with anything. These bait fish were sold if the larger species were scarce. After getting a suitable supply the boats moved offshore and anchored in 15-60 fathoms (30-120 meters) where the men simply dropped their leaded lines overboard. The principal species sought were cod (Gadus morhua), members of the drum family (Argyrosomus regius and Umbrina spp.), grouper (Epinephelus spp.), wreck fish (Polyprion americanus) and possibly the sea bream (Pagellus bogaraveo) and bluefin tuna (Thynnus thynnus).

After fishing action had stopped for the day the fish were cleaned and salted. This process involved evisceration, thorough washing, removal of head and fins, and draining off excess water. Then they were salted and stored in the hold. Fish preserved in this manner would keep for six to

[illegible] the Old Records us that the French in Newfoundland would [illegible] the fish a second time and re-salt them so that they kept longer. Moors simply dried the fish in open air (Glas 1764:338)

Another commercial species, the dogfish shark (Squalus acanthias), was valued not only for its flesh but also for its skin and oil (Townsend 1814, II:274) Sea turtles were an occasional catch by the fishermen who valued them highly for personal table fare (Glas 1764:212). The Mediterranean and portions of the Atlantic coast were fished more with nets for species like sardines (Sardina pilchardus) and anchovies (Engraulis encrasicolus).

For a time the Atlantic sealing and codfish industry was prosperous, but went into decline in 1713 following the Treaties of Utrecht concluding the war of the Spanish Succession in which Spain ceded Gibraltar and the island of Minorca to England, Sicily to Savoy, and the Spanish Netherlands, Sardinia, Milan, and Naples to Austria (Vicens Vives 1969:522, Judd 1966:471). Soon after this however, Catalan fishermen perfected the bous method of fishing--really a trawling process in which the net was dragged between two boats. This proved so successful that the idea spread along the Mediterranean coast by the mid-1700's, and enabled the development of a fish-salting industry to the north on the Atlantic coast of Galicia (Vicens Vives 1969:522). An additional factor in the late development of the Spanish fishing industry was its strict regulation until 1750 by the government including fixed prices for the catch (Townsend 1814, II 240).

Much of what is known of Spanish fishing technology comes from Antonio Sáñez Reguart, who in 1791-95 compiled his Diccionario Histórico de las Artes de la Pesca Nacional which has been called by George Foster (1960:77) " . . . the "finest study of material culture ever made." In his compendium Sáñez

describes three basic net types with numerous variations and two types of set lines or trot lines. The simplest net, the atarraya, was a conical-circular, weighted cast net 1.6 meters high and 10 meters in diameter. This handthrown net was the most popular of the non-commercial varieties (Foster 1960 77). The chinchorro or basic pocket seine was put out by boats and drawn in by men on the shore. The bottom was weighted and the pocket in the center kept from collapsing by cork floats. Its use was restricted to ocean beaches. Gill nets or trasmallos were anchored or left to drift freely with one end fastened to the boat. Some varieties had cork floats and lead weights, were 300-600 meters long and three meters deep with an eight to ten centimeter mesh. The principal quarry of these nets was thought to be the dogfish shark (Foster 1960 80), although variations on this theme, called ligeras, were used in the mullet fishery (ibid). One gill net variety, generally anchored with lead but kept from collapsing with cork floats, was constructed like a net sandwich with an inner net of fine mesh and two outer nets of coarse mesh.

The set lines or trot lines were of two types, the palangre which was 180 meters long and contained 75 hooks and the shorter, lighter espinel which nevertheless contained the same number of hooks. The espinel was baited and set out by a wading fisherman at low tide, then collected at the next low (Foster 1960 81)

In summary, traditional Spanish commercial fishing methods involve off-shore trolling, relatively deep-water offshore still fishing, some whaling, open ocean netting, inshore ocean-beach netting, intertidal trot lines, and seasonal riverine salmon fishing. Subsistence practices include use of cast nets and rod, hook, and line. Of the fishes listed in Table 2, only

salmon, hake, bluefish, [illegible] shark, pompano, horse mackerel, meagre, mullet, and barracuda might be considered as species liable to be caught by shore-based subsistence practises. With the exception of salmon, hake, and mullet, which sometimes ascend rivers, these fishes are marine species. Preparation of the catch included evisceration, removing the head, and salting for storage.

Food Prices and Availability

Our analysis of the Spanish food supply becomes more meaningful when we combine a rough knowledge of the relative abundance of various animal and plant species with data on prices obtained from journals of the period. Most helpful in this regard have been the detailed observations of Joseph Townsend in A Journey Through Spain in the Years 1786 and 1787. While written late in the period with which we are concerned, Townsend's observations of foodstuffs and their prices in some 14 towns and cities from the Andalusian port of Cadiz to the Mediterranean coast of Catalonia at Barcelona are at least a fair indication of the nature of the Spanish food supply in the last half of the 18th century.

Most meat seems to have come from professional butchers, whose prices according to species were fixed within a particular region by local government edict. However, prices varied greatly from region to region due to the problem of transport of perishable materials and the vagaries of supply from local livestock herds. This was not the case with maize, which had a stable price all over Europe. Fixed prices as meat allowed for no distinction between fat and lean, prime and coarse cuts and consequently there were complaints by visitors that the meat wasn't as good as that sold in a free market situation (Townsend 1814, I 307).

The last of the market reports reflected the interpretation of price and supply, but the consistent pattern reported by Townsend is encouraging. Beef was the lowest priced of the traditional domestic meats in 11 out of 12 cities where it was sold. Where distinction was made between veal and beef, veal (meat from calves) was more expensive in two of the three localities. Mutton was without exception more expensive than beef and in the one locality where distinction was made between lamb and mutton, lamb (sheep less than a year old) was less expensive. Mutton was sold in all 14 areas. Goat or kid (an animal less than a year old) was sold only in three of the fourteen areas for which Townsend listed prices, and an ambiguous picture emerges. In two towns it was the cheapest meat available and in the third, the most expensive. Pork, though sold only in four of the 14 localities, was consistently the price leader with the exception of the one town where kid was the most expensive meat available. In a fifth locality, pork was not sold but hog's lard led the price list. Fish was usually cheaper than meat from domesticated animals, and "fowl" usually sold for a price per pound between beef and mutton. A dozen eggs sold for about the same price as a pound of bacon and a little less than a pound of sausage (Kamy 1932:419).

Bread was the least expensive food item mentioned on a per pound basis, and barley bread was cheaper than wheat bread. Townsend distinguishes between wheat and corn (maize) and notes that although corn prices are stable, wheat fluctuates wildly (1814, II:101). If we may summarize some major agricultural corn prices, barley would be least expensive, followed by Indian corn (maize), French beans, and usually at the top of the list, wheat. Fruits and vegetables in great variety were bought in open markets and/or grown in home gardens.

Information from prices and market availability in Townsend's sample of 14 communities can give us further insight, particularly on livestock. Mutton seems to have been overpresent, followed closely by beef. Pork is a distant third in availability with goat or kid taking fourth place. Younger animals were not generally being slaughtered and presumably did not counteract their potential economic worth as wool-bearing or draft animals by any noticeable meat market price differential. Foster (1960: 71) notes that goat and pork are today more important than mutton as meat, yet Townsend's data tend to support Kenney (1969: 175) who in his studies of contemporary rural and urban Spain mentions that mutton and beef are the cheapest and most popular meats. At the same time it should be noted that a few pigs have traditionally been kept around rural and some urban households for home use and thus may not have really entered into the market picture. Goats, sheep, and cattle were additionally valuable as sources of milk and dairy products.

Cooking and Food Preparation

With the exception of posadas (inns), and former cookshops in the larger cities, cooking was done in the home and seems to have involved the same techniques throughout virtually all regions of Spain for a period of several centuries. In fact the pattern is so clear that we can describe the majority of Spanish cooking by describing two popular dishes.

Gazpacho, a cold broth or soup of bread, olive oil, water, vinegar, pepper, garlic, and onions (Cervantes 1949-59, Glas 1764: 206, Kany 1932: 146) was either an appetizer or the main dish at a light meal. The single most popular dish, known variously as puchero or olla podrida (and occasionally cocido) was a stew of innumerable combinations of meat and vegetable ingredients cooked together in an earthenware vessel. In fact the

[illegible]ior difference between puchero and olla podrida seems to have been that the olla podrida had a few more costly ingredients thrown in (Kany 1932 146). Townsend informs us that the common invitation to dinner, even in the houses of the wealthy, was "[illegible] to partake of their puchero, or, as we say, to take pot luck" (1814, I 114).

A traveler to Madrid in 1691 described a very meager puchero at a corner cookshop which was "... a kettle of beans, garlic, leeks, broth, and bread ." (D'Aulnoy 1930 193). Don Quixote de la Mancha no doubt was describing a full-fledged olla podrida (circa 1605) when he and Sancho Panza stumbled onto a wedding party serving guests from ". . large stew pots with sheep, hares, hens, geese, and game birds [illegible]" (Cervantes 1949 637). The same duo were later disappointed by a simple stew-pot of cow heels boiled with garbanzos, onions, and bacon (Cervantes 1949 894), and Sancho Panza railed at his hosts after they fed him a dish of beef, onions, "and a few boiled calves' feet," complaining that "[illegible]. my stomach, which is used to goat's meat, beef, bacon, hung beef, turnips, and onions [illegible]" and "[illegible]. olla podridas full of good things ..." (Cervantes 1949 824). Another traveler described a noon meal of "[illegible] beef, mutton, pork, bacon, carrots, turnips, potatoes, peas, onions, and saffron all stewed together ..." (Glas 1764 289).

Pucheros, cooked in an earthenware pot, were additionally valuable in that they saved fuel in a country in which wood was already scarce. The plain earthenware pot was generally hung in the fireplace (Irving 1937 63), although Townsend alludes to a special enclosure to further concentrate the heat and save fuel (1814, I:113).

There were certainly other cooking and food preparation techniques. Perhaps the most popular following the puchero genre stews was roasting. Fish, mutton, beef, goat, pork, turkey, chicken, and other birds were commonly roasted over open fires or in fireplaces. Perhaps the most outrageous description of roasting comes from the pen of Cervantes, who in describing Don Quixote's "cranking" of the wedding feast of a wealthy landowner's daughter tells us of a large steer roasting on a spit over an open fire, complete with several suckling pigs sewed up inside the steer's belly for an even more opulent display (1945 637)

Other techniques included frying in oil, usually chicken, eggs, bacon, vegetables, and sausage, boiling eggs, bacon, vegetables, calves' feet, milk, bread, and fish, stone boiling of ewe's milk for initial coagulation in cheese production (Foster 1960 71), baking bread and meat pies, and broiling, usually chicken. In the 18th century French cooking became popular in upper class houses and fricassees, which involves boiling and then frying meat, was introduced (Kany 1932 146) The common puchero was somewhat dignified by minor changes in spices and was called fricando (fricandeau) or ragout. Techniques of preservation included pickling of pork or veal, drying of fish, fruits and nuts, salting of fish, and sausage-making.

In spite of introduction of new foods to Europe from Africa, Asia, and the Americas after the 16th century, no real "international cuisine" developed. Instead, foods became somewhat nationalized (Tannahill 1973 242) This vertical stratification of foods came into existence and cut across the previously existing dichotomy between the foods of the wealthy and those of the common people. Throughout the literature we read statements of the distinc- between the food of the upper and lower classes

In the Canary Islands, 'The food of the natives is principally what they call goffio, which is flour of wheat or barley, toasted; this they mix with a little water, and bring to the consistency of dough, and thus eat it." (Glas 1764:201) Sometimes the goffio was dipped in honey or molasses--no utensils were required. When milk was available in the winter season, the goffio was immersed in it and dipped out with sea shells (ibid.). Gentlemen, however, ate large mess meals of ollas podridas filled with meat and vegetables and topped off with a second dish of roasted meat and a dessert of fruit and sweetmeats (Glas 1764:289). Fishermen in the islands boiled fish and then poured the broth in a platter over broken biscuits, shredded onions, pepper, and vinegar. An additional treat for them was roasted fish (Glas 1764:338)

In Spain itself postherders and travelers lunched on dried amorne, cheese, meat, and wine (Cervantes 1949:81) and were lucky to get a supper of hard-boiled eggs, fish, tomatoes, rice, and milk (Irving 1937:45) Townsend mentions that the common people "... eat little flesh, drink little wine. Their usual diet is Indian corn, with beans, peas, chestnuts, apples, pears, melons, and cucumbers; their bread, also of Indian corn, has neither barm nor leaves, but is unfermented, and is the state of dough " (1814, I 293). Later on he says that in summer, Andalusian peasants ". . live chiefly on bread, vinegar, and oil . . ." (Townsend 1814, II 53). Contrast this with the meals served at a bishop's house, which included a preliminary soup or gaz-pacho followed by an olla podrida consisting of beef and mutton, bacon, sausages and garbanzos, to which was occasionally added veal, chickens, roast wild game and fish (Townsend 1814, I 284).

In the cities, lower classes were characterized by their reliance on puchero, lettuce, watercress and oil salads, cold ham, bread, acorns or chestnuts, and cucumbers and garlic diced and fried in oil (Kany 1932 147). Milk and butter were scarce, but fried sausage or pickled pork were often available for breakfast with bread (Kany 1932 149, 150). Upper classes generally ate olla podrida or roasted wild game or domestic animals. They had a fascination with "water ices," flavored beverages made from virtually every fruit, root, leaf, herb, and seed (Kany 1932 148). Both classes enjoyed chocolate, particularly in the mornings. The best chocolate supposedly came from Bolivia, with the next best grade originating in Mexico. Peru and Venezuela had less favored varieties. By 1772 there were nearly 150 chocolate manufacturers in Madrid, by 1773 they had formed a guild to protect consumers against the additions of almonds, pine nuts, flour, acorns, coffee, bread and cake crumbs, and pepper and orange peels by unscrupulous grinders (Kany 1932 152).

The dichotomy between foods of the upper and lower classes was not so much absolute in all places as it was in the relative sense--the essential difference between the well-to-do and the common people in essence was the distinction between the contents of the puchero and the olla podrida. The distinction can hardly be made more succinctly than it was by this traveler to the Canary Islands in 1764. "The food of the common people in this country is generally coffio, fruit, and wine, with salt fish which is brought to these shores from the coast of Barbary in great abundance ... fresh fish in the summer is tolerably plenty, but at other times more scarce and dear. I need not describe the food of the gentry, because in all countries they live on the best ..." (Glas 1764 284)

[illegible] drastically reduced the [illegible] economy in [illegible] was the season of Lent, 40 days of abstinence [illegible] in which fish, bread, and vegetables were the primary subsistence [illegible] Nevertheless when fish was scarce one could purchase a licensse "[illegible] from the Pope's Nuncio which allows them to eat butter, cheese, and the head, feet, and innards of fowl, etc . ." during Lent and on Saturday (D'Aulnoy 1930 221) Money could also obtain mutton, beef, and other meats from officially closed butcher shops during Lent (ibid.)

It is interesting to know that medieval monks in Spain were the first to domesticate the rabbit The object of this domestication effort was to ensure a supply of laurices, or fetal or newly-born rabbits for Lent, since under the rationale of the time they were not considered as meat (Zeuner 1963 413) Townsend notes that by purchase of special indulgences there were four days a week during Lent that individuals might eat flesh, but few people took advantage of it (1814, I:87). Normally Wednesday's and Friday's meals were based on fish (Townsend 1814, I:285)

Testable Implications

Initially the possibility was raised of outlining testable implications concerning resource use and dietary change relative to Spanish colonists in the New World. This discussion has summarized the resources used by the Old World Spaniards and the resultant culturally patterned adaptations The selective transfer and use of these food resources has important ramifications for the archeology of New World Spanish colonial sites. The implications are as follows:

1) If New World agriculture reflected Spanish models in regard to economic crops, characteristic field shape and type of

plowing, and home gardens and orchards, then evidence should exist for major use of wheat and other cereal grains, pulse beans, and numerous fruit trees. Economic crops should be raised in square-shaped fields plowed by oxen. House lots should include space for gardens and fruit trees.

2.) If domestic animal use followed the economic and dietary use pattern of Spain, then domestic animal bones should include in order of percentage representation sheep, cattle, pigs, chickens, goats, an assortment of domestic fowl such as ducks, geese, doves, and pigeons, and should represent the major animal dietary contribution.

3.) If hunting and collecting of wild foods was limited and showed concentration on very few species as in Spain, then bones of wild animals should be scarce in New World colonial sites. These species that are present should be principally deer, rabbit (hare), birds of the upland scrub, and coastal birds and their nestlings.

4.) If fishing concentrated on commercially obtained pelagic, deep water marine species taken by a variety of fishing hardware as in Spain, then bones of large, deep water species should be present, although bones of the cranial region should be rare due to market preparation. Fishing hardware should be scarce unless site are linked to a commercial fishery, where professional hardware is present it should include large line and net weights, barbed and unbarbed hooks in a variety of sizes, brass wires, and netting tools. Subsistence fishing should be represented by small hooks, lead line weights, and small net weights.

[illegible] Spanish models of cooking were followed, chiefly in preparation of meat and vegetable stews and use of large quantities of oil and wine, then the great majority of cooking vessels should be utilitarian earthenware pots. Few bones should show charring on the ends resulting from roasting practices. Container jars should be present for the storage of oil and wine

6) If Spanish Lenten season dietary habits were reflected in household midden debris, especially in lower-class Catholic homes, then accumulations of fish bones and possibly plant food remains should occur as distinct from normal eating and discard patterns which should result in higher percentages of domestic animal bone

7) If social class differences were reflected in the diet as in Spain, then there should be an increase in the relative percentages of meat and fowl with increasing social status

Discussion of the tests of these implications will be presented throughout the sections on New World sites and will be summarized in the final chapter The result of these implications, in reality a test of Old World Spanish subsistence system tenacity confirmed or unconfirmed by archeological and documentary evidence, will enable us to determine more accurately the specific nature of the cultural/biological exchange between Spain and the New World, and beyond that, to guage the importance of other than purely environmental factors which lead to any observed change in the Spanish models One of the principal factors which will be taken into account in

[illegible] the significance of acculturation as an adaptive mechanism in the foodways of select New World aboriginal and Spanish groups should contribute elsewhere to the resolution of larger problems in cultural dynamics

CHAPTER I

[illegible] EW WORLD - [illegible]

Aboriginal Subsistence at Contact

At the time the Spanish arrived in the New World the Caribbean [illegible] peoples based their subsistence almost equally on cultivated root and vegetable crops and on products of the sea. Their agricultural and food procurement capabilities were a blessing for the Spanish, who apparently could not have survived for long on their own (Morison 1963 223), and a curse to the aborigines themselves, who would soon see their population decimated and their culture collapse under the incessant pressures and demands of Spanish colonialism.

Studies of animal bones recovered from pre-Columbian sites in the Caribbean indicate a variety of marine-oriented subsistence techniques, including fishing with boats, fish traps, hook and line, and possibly nets (Wing 1968). Additional techniques known from historic sources included use of harpoons, bow and arrow, poles, fish poisons, and the remora or sucker-fish which attached itself to a larger fish or turtle and was hauled in by an attached line held by the fisherman (Morison 1963: 82, Sauer 1966 58, Vérin 1968). These techniques change with site location and intended prey and reflect use of locally available, variably productive environments, such as estuaries, inshore banks and reefs, offshore banks, and offshore eclogic zones. Fresh water ponds and rivers were also fished occasionally.

Marine fishes commonly caught include species from four [illegible] habitats:

1) estuarine and inshore pelagic (open water) sharks, rays, tarpon, snook, certain snappers, jacks, porgies, barracuda, and mullet,
2) inshore banks and reefs: seas, grunts, parrotfish, porkfish, snappers, surgeonfish, triggerfish, and wrasses,
3) offshore banks: groupers, jewfish, and snappers; and
4) offshore pelagic: tuna and dolphin.

The ichthyfauna of any particular site tend to represent proportionately the nearest productive habitats (Wing 1968).

Sea turtles were often caught on beaches (Oviedo 1959 III) but were at least occasionally taken in open waters by fishermen with nets (Sauer 1966 58). The largest recorded individuals of the family Cheloniidae weigh 800-900 pounds, although leatherback turtles (Dermochelidae) attain weights of over half a ton (Carr 1952). Sea turtles of up to several hundred pounds were overturned on the beach and rendered helpless as they came ashore to lay eggs. Other techniques for catching turtles were harpooning and roping or lassoing the fins as the animals were swimming (Varin 1968).

Manatee were also harpooned and occasionally taken by net, but Oviedo describes the most unique method. While browsing on aquatic vegetation in shallow water, the manatee would be stalked by a fisherman in a dugout canoe and shot with a barbed arrow to which was attached a tarred line and a float. After tiring from its efforts to escape, the manatee could be

[illegible] into [illegible] and then dragged ashore by waiting helpers (Oviedo 1959:113).

Other marine food sources [illegible] collected in shallow, protected waters, in estuaries, and on land, and various molluscs. The Indians dove for lobsters (Vérin 1968), conchs (Morison 1963:97), and oysters, the latter primarily for pearls (Oviedo 1959:116). In terms of food energy, fish were certainly the most important marine resource.

Land animals make up the bulk of subsistence resources in a few Caribbean aboriginal sites in spite of the very limited number of mammal and large reptile species on these islands. Important species included the hystricomorph rodents, agouti (Dasyprocta agouti) and hutia (Capromys sp., Geocapromys sp., and Plagiodontia sp.), a now extinct rice rat (Megalomys sp.), iguanas, and a small variety of domestic dog which the Indians raised for food (Sauer 1966:59). Cories, or guinea pigs (Cavia sp.), seem also to have been introduced into the Caribbean by the aborigines as domesticated animals. Snakes and insects were a very minor source of food (Morison 1963:219), but the crocodile (Crocodylus acutus) was at least locally important within its range. Human cannibalism was an additional food source in some areas of the Caribbean.

Marine, shore, and terrestrial birds were eaten with some regularity, and in some areas of the Caribbean the muscovy duck was domesticated (Sauer 1966:59). Oviedo (1959:22-23) described a method of hunting waterfowl whereby the birds resting on the surface of the water were stalked by Indians wading shoulder-deep with their heads enclosed in a large gourd. The birds, accustomed to other gourd float "decoys" bobbing at anchor nearby, took no notice of another drifting their way until they were quickly pulled under by

[illegible] and ground [illegible]rds were [illegible]led down at night from roosting trees (Oviedo 1959 1[illegible], Sauer 1966 58), and ground nesting shore-birds were easy prey The West Indies tree duck may have been domesticated or at least kept (Morison 1963 91, 131), but it is doubtful that the turkey was present before the Spaniards brought domestic stock to the islands from Mexico

The major agricultural products of the islands were vegetatively-reproduced root crops, of which the bitter manioc (cassava, yuca, Manihot sp) and a variety of sweet potato (Ipomoea batatas) were the largest producers. The agricultural process started with the clearing of trees by either felling or girdling and sometime later setting fire to the dry debris With digging sticks the earth was heaped into a series of rounded mounds, or montoons, which were up to knee-high and several feet wide. Stem cuttings were then pushed into the loose, well-aerated soil of the mounds, in addition to any seeds or grain desired Fields of these mounds, irregular in shape, were called conucos and were well adapted for variable topography and effective against soil erosion (Sauer 1966 51).

Not all fields consisted of these raised mounds Oviedo (1959:14) described similar clearing procedures for a field of maize but mentioned only planting with the aid of a digging stick with no construction of montoons Columbus' accounts of agriculture in Cuba mentioned the Indians digging in fields, and their leveled, planted fields of squashes (Morison 1963:107, 108)

The conuco method did not lend itself to true shifting cultivation, nor was this necessary due to the fertile soils and relatively modest mineral demands on the soil by the balance of root and vegetable crops

The growing and harvest [illegible] made due to the nature of the climate and the crops grow[illegible]er, some more arid areas of Hispaniola required irrigation by an extensive canal system which was certainly pre-Columbian (Las Casas and Peter Martyr in Sauer 1955 53). Sauer has calculated that a one-acre field of 500 mantones would produce yearly 3500-4325 pounds of processed cassava, and cites Las Casas in stating that one carga (50 pounds) of cassava bread would provide food for a month for one person (Sauer 1966 54).

Other root crops were peanuts, yautia, arrowroot, llerén, yampee, and canna. Maize, beans of several varieties, capsicum peppers, and squashes were also grown. Fruits included the mamey (mammee), pineapple, guava, coco-plum, soursop, and papaya.

Cultural Exchange of Plants and Animals

The principal aboriginal groups in the Caribbean were the Arawaks and the Caribs, of which the Arawaks were said to be more tractable from a European viewpoint. To the Spanish, an Indian who practiced cannibalism and used poisoned arrows was a Carib (Sauer 1966 6), although the real reason for the Spanish distrust of the Caribs and affinity for the Arawaks was the difference in socio-political organization between the two groups.

The Arawaks were in the process of developing a primitive state when the Spanish arrived and were organized under hereditary rulers or caciques (Rouse 1963 528). The Spanish already had experience in taking over a feudal system by deposing the ruler and establishing their own figurehead to continue the system, so the Arawaks posed no problem. The Caribs, on the other hand, were not as centrally organized and were thus not as quickly subdued by Spanish methods of conquest.

Nevertheless, both groups suffered heavy losses due to actual fighting with the Spaniards, the more insidious European diseases, and the slavery and forced labor that produced food for Spanish consumption and gold for the royal treasury. Essentially all of the 5-6 million natives in the West Indies were gone within a generation of Columbus' first voyage of discovery, making the importation of large numbers of African slaves a necessity for the maintenance of the Spanish colonial system (Las Casas 1906, Sauer 1966, Haag 1968). Referring in 1620 to Hispaniola, the Carmelite Friar, Antonio Vázquez de Espinosa (1968:39), tells us that "At the time of its discovery it contained 1,800,000 Indians, not counting old people, women, and children, they were the first Christians in the Indies, today there is not one Indian in all the island, it was a just judgment of God." Even though the figures may be exaggerations, it is obvious that there was little possibility of any lasting effect of Spanish-introduced foodstuffs on these island peoples. Nevertheless, many Caribbean aboriginal sites contain domestic animal remains in the upper layers (Wing 1967, 1969, 1972, Wing et al. 1968).

There is little documentary evidence to indicate widespread early adoption by the Caribbean Indians of any Spanish cultigens with the exception of plantains and bananas (Oviedo 1959:102). European domestic animals were another matter. Smaller domestic animals such as pigs and chickens were rather quickly accepted. The Spaniards saw no threat in the Indians having small "barnyard" animals, and they were thus more readily available than the larger herd animals. A more plausible factor in their acceptance by the aboriginal peoples was that keeping pigs and chickens involved no major alteration in the Indian life style (Crosby 1972:96).

Through the Arawaks and the Caribs the Spaniards were exposed to and survived and prospered on maize, cassava bread, sweet potatoes, pineapples, sea turtles, iguanas, and numerous estuarine, inshore, and reef and bank fishes. Columbus' first encounter with reef fishes used by the natives of the Bahamas for food left no doubt concerning his unfamiliarity with them as he stated, "Here the fishes are so unlike ours ..." (Morison 1963:72). Yet later on his first voyage, Spanish seamen cast nets in one of the estuarine rivers of Haiti (Hispaniola) and caught mullet "... like those of Spain ... up to that time he had not seen fish like those of Castile" (Morison 1963:114). In their haste to identify and name similar-appearing fishes as these familiar ones from the Eastern Atlantic and the Mediterranean, the early Spanish explorers left a legacy of common-name taxonomy that is still a source of confusion to modern workers in the Caribbean.

The second voyage of Columbus was really the first major introduction of Spanish domestic plants and animals, as he returned to Hispaniola with dogs, cats, horses, sheep, pigs, goats, cattle, seeds and cuttings for wheat, grape vines, garbanzos, broadbeans, cucumbers, sugar cane, onions, radishes, melons, salad greens, and various fruit stones or pits to start orchards (Morison 1963:217). Some authorities say the Spanish demand for European foods in their new environment was strengthened by social and racial prejudices (Crosby 1972:106). However, more simplistic explanations have been offered:

> ... it is not surprising that man, whether possessing a permanent abode, or having emigrated to a distant land, should become attached to those animals which have preferred to him their perfect obedience, sagacity, courage, strength, and other kind offices, and should regard them with admiration, gratitude, and even affection. Such,

> doubtless, was th[illegible] early [illegible]
> turers who sought a new [illegible] shores, and brought
> with them those animals which would render them the
> most assistance or protection, and subserve the best
> purposes for labor, pleasure, clothing, and food.
> (Browne 1854 1)

For whatever reason Spanish plants and animals appear to have been introduced wholesale This documentary evidence is certainly an indication that the implications concerning introduction of Old World Spanish agricultural crops and livestock have potential validity.

Lush pastures, tropical fruits and tubers, a favorable climate, and a lack of competitors allowed unprecedented population growth of cattle and pigs, particularly in the early years of colonization. Citing these environmental factors as the reason, Oviedo (1959 11) declared the cattle of Hispaniola to be " .. larger and more handsome than those of Spain." Cattle were so successful that in 1587 Hispaniola sent 35,444 hides to Spain (Crosby 1972 87) In fact the term "buccaneer" appears to have been derived from numerous scattered groups of hunters on the north shore of Hispaniola, who made a living by killing wild cattle for skins and selling meat smoked and dried over a boucan, or green wood grating, to passing ships (Esquemeling 1893, Haring 1966 57)

Expansion of feral European animal populations of cattle, pigs, and dogs and subsequent crop destruction may have been a factor in the decline of aboriginal populations and certainly was the decline of Caribbean wild animal populations (Oviedo 1959 11; Esquemeling 1893 34, Crosby 1972 98) In more remote areas, such as small islands, goats became the dominant fauna Sheep were slower to adapt in the Caribbean and did not fare as well in the wild as they were less capable of defending themselves against predators (Crosby 1972 92), such as the large dogs introduced by the Spanish These feral dogs were particularly destructive when they hunted in packs (Esquemeling 1893 34)

but grapes, garden vegetables, citrus, and other fruits grew well Sugarcane grew spectacularly and became the only major economic plant crop of the islands (Vicens Vives 1969 321). The aboriginal crops, maize and cassava, took the place of wheat in the Spanish diet in the early years and continued to be a significant contribution even after regular trade was established between the West Indies, the Canaries, and Spain. Vázquez de Espinosa (1968 39), writing of Hispaniola in the early 17th century, said " ... the everyday bread here is cassava ... as for wheat and other Spanish products, they neither existed here nor do they grow ... " A major factor in the Spanish use of cassava bread was its ability to keep fresh for a year or more (Oviedo 1959:17). Major modifications to Spanish models of cereal grain production and sheep herding were thus partially attributable to local environmental factors in the Caribbean, and largely to the success and convenience of aboriginal cultigens After initial attempts to replicate Spanish agricultural models, Indian, and later, Spanish production of aboriginal crops prevailed

Archeological Situation

In general, the archeological and subsequent zooarcheological examination of Spanish colonial sites in the Caribbean has, with the limitations imposed by preservation bias in favor of animal remains, confirmed the historical picture of heavy reliance on European domestic animals with occasional use of local marine fish, mammals, birds, and reptiles. Nevertheless there is much we can learn concerning the specific nature of the exploitation of these wild and domestic animals

Convento de San Fr[illegible]

In 1954 a small portion of a wall garden was excavated under the direction of John M. Goggin at the ruins of the Convento de San Francisco, in the city of Santo Domingo in the Dominican Republic on the island of Hispaniola (see Fig. 1). The animal bones recovered in that excavation and subsequently brought to the Florida State Museum form the basis for this discussion. A full site description may be found in a recent study by R. Bruce Council (1975). The only previously available archeological information on the site (other than a brief report by Epidio Ortega in a 1974 issue of the Boletin del Museo del Hombre Dominicano) was a short description by John M. Goggin (1968) in his posthumously published Spanish Majolica in the New World.

The city of Santo Domingo, founded by Christopher Columbus' brother Bartholomew in 1496 and moved to its present location in 1502 by the new Spanish governor, Ovando, is the oldest continuously occupied European settlement in the hemisphere. Santo Domingo was particularly important as a port city during the 16th and 17th centuries as Spanish colonial ventures flourished, and the base of operations was still in the West Indies. The spread and maintenance of Catholicism was a primary concern in addition to Spanish economic interests, so it is not surprising that the Franciscans were on hand almost from the beginning. They chose a site within the first decade of the 16th century, located on a low hill in Santo Domingo, as a religious headquarters for the province of Santa Cruz de Española. Construction began shortly after on the site overlooking the Ozama River and eventually consisted of the Convento de San Francisco itself and the adjacent conventual and parochial churches (Coggin 1968:32). The major occupation of the site

[illegible] 15th century and to have lasted at least 300 years [illegible]. There is evidence that from the start the accumulating refuse was used deliberately to level and terrace the steep hillside (Goggin 1968:101). Since the materials were recovered immediately south of the Franciscan monastery, it was assumed that they represented the refuse from the domestic life of the priests.

The problem-oriented nature of the excavation, to establish a classification and seriation of Spanish majolica, did not lend itself to maximum recovery of faunal remains. "Bones were also widely scattered from top to bottom of the site, with one zone of almost pure bone. The quantity found was very great. Several unidentifiable bushels of chips and fragments were discarded in the field." (Goggin 1968:104). Therefore no attempt will be made at quantification of the remains beyond a species list, Minimum Number of Individuals (White 1953), and percentage representation calculated from rather broad time periods (adapted from data in Council 1975). This list constitutes a portion of Table 3.

We certainly can learn from what we do have of the Chaveate bones, in spite of the fact that the sample may not be wholly representative. The great majority of bones and 52.8 percent of the Minimum Number of Individuals are from European domestic animals. This supports the implications regarding transfer to the New World of Old World livestock use, although certain new information on New World Spanish animal husbandry has been observed from the bones.

Bones of the domestic pig (Sus scrofa) represented 12.6 percent of the combined Minimum Number of Individuals (hereafter referred to as MNI) of all species present in the collection. Age of the domestic mammals at

Table 3 Vertebrate Species Representation by Minimum Numbers of Individuals, Caribbean Site

Species	Convento de San Francisco						[illegible]	
	16th C	Early 17th C	Mid-late 17th C	Early-mid 18th C	Total	% MNI	Early-mid 16th C	% MNI
MAMMALS								
Sylvilagus floridanus Cottontail rabbit							1	[illegible]
Cetacean Whale or porpoise				1	1	[illegible]		
Canis familiaris Domestic dog							1	[illegible]
Felis catus Domestic cat	1				1	[illegible]	1	[illegible]
Trichechus manatus Manatee	1	[illegible]	[illegible]		3	[illegible]		
Sus scrofa Domestic pig	4	1	4	2	11	12 6	[illegible]	[illegible]
Odocoileus virginianus Deer							[illegible]	[illegible]
Bos taurus Domestic cow	[illegible]	[illegible]	[illegible]	3	[illegible]	[illegible]	[illegible]	[illegible]

Table 3 Continued

Species	Convento de San Francisco						[illegible]	
	Early 16th C	Early 17th C	Mid-late 17th C	Early-mid 18th C	Total	% MNI	Early-mid 16th C	% MNI
Ovis aries Domestic sheep	3			1	4	4.6		
Caprinae Sheep or goat	8	1	5	1	15	20.7	4	7.1
BIRDS								
Pelecanus sp. Pelican							1	1.8
Sula sp. Booby							1	1.8
Phalacrocorax auritus Double-crested cormorant							4	5.4
Cairina moschatus Muscovy duck							1	1.8
Coragyps atratus Black vulture							1	1.8
Gallus gallus Domestic chicken	1		1		4	4.6	1	1.8

Table 3 Continued

Species	Convento de San Francisco						Nueva Cadiz	
	16th C	Early 17th C	Mid-late 17th C	Early-mid 18th C	Total	% MNI	Early-mid 16th C	[illegible]
Meleagris gallopavo Domestic turkey	1				1	1.4		
REPTILES								
Chrysemys sp Pond turtle	2	1	2	2	7	8.0		
Chelonia mydas Green turtle	1				1	1.4		
Cheloniidae Sea turtle		1			1	1.4	[illegible]	[illegible]
FISH								
Galeocerdo cuvieri Tiger shark			[illegible]		1	1.4		
cf Rhizoprionodon terraenovae Atlantic sharpnose shark							[illegible]	[illegible]
Megalops atlantica Tarpon	[illegible]				1	1.4		
Dagre marinus Gafftopsail cat[illegible]							1	1.4

Table 3. Continued

Species	Convento de San Francisco						Nueva Cádiz	
	16th C	Early 17th C	Mid-late 17th C	Early-mid 18th C	Total	% MNI	Early-mid 16th C	% MNI
Ariidae Sea catfishes							7	[illegible]
Batrachoididae Toadfishes							[illegible]	[illegible]
Strongylura sp. Needlefish							[illegible]	[illegible]
Centropomus sp Snook	3	2	1	3	9	10.3	[illegible]	[illegible]
Serranidae Sea basses	1	1	2	1	5	5.7		
Caranx sp Jack			1	1	[illegible]	[illegible]	[illegible]	[illegible]
Selene vomer Lookdown							[illegible]	[illegible]
Carangidae Jacks and pompanos	1				1	1.1		
Lutjanus sp Snapper	[illegible]	[illegible]			2	2.3	[illegible]	2.5
Haemulon sp Grunt							[illegible]	2.5

Table 3. Continued

Species	Convents de San Francisco						Nueva Cadiz	
	16th C	Early 17th C	Mid-late 17th C	Early-mid 18th C	Total	% MNI	Early-mid 16th C	% MNI
Archosargus sp Sheepshead							1	
Calamus sp Porgy								
Sparidae Porgies								
Cynoscion sp Seatrout								
Sciaenidae Drums								
Chaetodipterus faber Atlantic spadefish								
Lachnolaimus maximus Hogfish								
Sparisoma sp Parrotfish								
Mugil sp Mullet								
Sphyraena sp Barracuda			1		1	1.1	6	

Table 3 Continued

Species	Convento de San Francisco						Nueva Cadiz	
	16th C	Early 17th C	Mid-late 17th C	Early-mid 18th C	Total	% MNI	Early-mid 16th C	% MNI
Scombridae Mackerels and tunas							3	
Sphoeroides sp. Puffer							1	
TOTALS	34	15	23	15	87			

time of death may be calculated by observing tooth eruption and the degree of epiphyseal fusion of various long bones (Silver 1969). The pigs from the Convento refuse were all butchered between one and two years of age, which is much later than the modern standard of six months in controlled diet commercial production units. The great majority (73%) of the Convento pigs were killed between the ages of 18 and 24 months.

Cattle (Bos taurus) remains comprise 14.9 percent of the combined MNI, and reflect a much broader age range at death. This suggests that cattle had broader utility than as simply a food source. Nine individuals represented were killed before 12 months and would thus not qualify as "veal." The mode was between 30 and 42 months, and 85 percent of the cattle were killed before they were 48 months old. In a sense all the cow remains are of "beef cattle," but dairy or draft animals would be expected to have a longer productive life before contributing in a more direct way to the diet. Two individuals (15%) of the cattle were older than 48 months, and one was over 84 months of age. One or two individuals might more properly be called oxen due to their size, although there is not enough of a sample to note any modal tendencies in bone size attributable to female, male, and castrate forms (Chaplin 1971:101-107).

Only four individuals of the Caprinae sub-family (sheep/goat) in the collection could be separated as to genus and species. On the basis of the ratio of the condylus of the distal metapodial (Boessneck 1969:355) all four were identified as sheep (Ovis aries). A more striking difference in age clustering than was found in other domestic forms was noted in the sheep/goat category which comprised 25.3 percent of the individuals of all species

[illegible] represented, five (24%) were [illegible] 12 months of age, qualifying for a modern "lamb" or "kid" designation. Two-thirds of the animals were older than 21 months. The mode, however, was in the over-36 months age bracket (eight individuals or 38%), suggesting that at least this last group had important utility in wool or milk producing or as breeding stock. The large number of sheep represented in the Convento midden almost certainly represent a shepherded flock, since we know that sheep did not do well in the wild. The sheep and some other animals were apparently kept in or close to the town, for in 1628 half the actual area of the city of Santo Domingo was occupied by gardens and corrals for pigs and sheep (Alcazar 1943 32). The percentage representation of the major individual domestic animals, sheep (or sheep/goat), cattle, and pig, support the implications regarding transfer of Old World domestic animal use practices.

The only wild mammal bones in the collection were those of two species of marine mammals, the manatee (Trichechus manatus) and a Cetacean, probably a porpoise. The manatee was a completely new animal to the Spanish who, through the Indians, recognized it as a good source of meat. In the account of his father's fourth voyage, Ferdinand Columbus described a manatee caught off the coast of Hispaniola:

> It is as big as a calf, resembling one both in color and flavor, except that perhaps it is somewhat better and fatter. Therefore, those who declare that there are in the sea all sorts of creatures which live on land, say that these fishes are real calves, since inside they are nothing like a fish, and feed only on the grass they find along shore. (Morison 1963 325).

Sauer (1966-58) notes that manatees were an important source of food until decimated by the Spaniards, who were permitted to eat them on fast days

No manatee [illegible] were found in [illegible] at this time. The large iguanas which inhabit the Indies were also exempt from religious dietary prohibitions, and although not present in Goggin's material, Elpidio Ortega has reported iguana remains from recent excavations at the Convento site (personal communication). This is certainly an extension of the application of Renaissance concepts of natural history to Church practice as previously noted in the discussion of food practices in the Iberian peninsula.

All of the remains of the manatee are the characteristically solid, dense ribs. There are at least three individuals in the collection, each no doubt representing a substantial amount of meat as manatees weigh up to 1200 pounds. All of the ribs exhibit cut marks, and one in a 16th century level appears to have been made into a tool. It is 15 cm long, cut squared-off at one end where it appears to have been battered as if by pounding, and scored, smoothed, and slightly waisted near the other end, as if hafted there. The data on wild foods from the Convento debris supports the implication that hunting and collection of these resources by the Spanish in the New World, as in the Old World, was limited. However, the types of wild foods differed from Old World Spanish models, possibly due to a combination of environmental differences (resource availability), Lenten restrictions, and models of aboriginal resource use.

Several domestic chickens and one turkey are the only birds represented in the Convento material. The turkey, from a 16th century level, was almost certainly introduced by the Spanish as a domesticant from Mexico. The chickens were without exception fully mature individuals, and

although sex could only be determined in one, a female, it is suggested that chickens were kept more for egg than for meat production.

There is fairly even distribution through time of freshwater pond or slider turtles (Chrysemys sp.). These turtles are common in the island's interior ponds and rivers (Cochran 1941) and were probably trapped. Sea turtles (Cheloniidae) were not as common as might have been expected from reading the early accounts. Only one of the sea turtles could be identified to genus and species, the green turtle (Chelonia mydas). Esquemeling (1893-94) noted that green turtle and loggerhead (Caretta caretta) were the best of the four available species for food. In the 17th century it was common practice for the inhabitants of Hispaniola to go to nearby small islands like Savona to catch nesting sea turtles (Esquemeling 1893:18).

Fishing was probably of a limited commercial nature, as it appears from the fish remains that there was some offshore reef and bank fishing and a concentration "... on a brackish water--littoral zone." The "shelf" is extremely narrow directly off Santo Domingo and also for several miles to the east and west. The drop-off is almost immediate to over 300 fathoms (U. S. Navy Hydrographic Office 1960), making "inshore" fishing almost impossible in the immediate area of Santo Domingo, with the exception of the harbor formed by the mouth of the Ozama River. Most of the inshore pelagic and reef fishing not in the harbor itself probably concentrated a few miles east or west. The large snappers (Lutjanus sp.) and grouper (Serranidae) must have come from offshore reefs or banks. Snook (Centropomus sp.), barracuda (Sphyraena sp.), jack (Caranx sp.), tarpon (Megalops atlanticus), and tiger shark (Galeocerdo cuvieri) were most likely taken closer to shore in open water or in estuarine bays. Handlines would have

been more efficient than nets for most of these fish, although some of the shallow water fishes, particularly the snook, shark, tarpon, and barracuda, may have been speared. Oviedo (1959:112) mentions the practice of catching sharks from moving vessels by trolling a hook with chain leader from a stout rope. The meat was used by the sailors after being cut into strips and air dried. While all shark meat was good, the best-tasting meat apparently came from younger individuals. Occasionally tuna or porpoises were harpooned from the moving ships (Oviedo 1959:114).

Characteristic Caribbean reef fishes, such as grunts, parrotfish, triggerfish, and wrasses, are not present in the Convento midden and this probably reflects the distance to a shallow reef habitat more than any particular food preference. Mention has been made of an active trade between Hispaniola and Venezuela during the 16th century involving the exchange of salted Venezuelan fished for manufactured items from Hispaniola (Mendez-Arocha 1963). There is no archeological evidence to support or refute this fish trade in the Convento materials. Most of the fish remains from the site were vertebra, as would be predicted from the implications concerning Old World Spanish fish salting and market practices, but snook were represented also by cranial elements. Most of the materials were either fragmentary or the elements represented do not permit identification beyond the family or generic level, eliminating any chance of identifying a species restricted to either Greater Antillean or Venezuelan waters. Data on New World Spanish fishing techniques reflected in the Convento midden debris were generally not supportive of the implications regarding a transfer of Old World deep water commercial fishery practices.

Other wild foods included small numbers of molluscs, most frequently the West Indian top shell (Cittarium pica), found on intertidal rocks. Other species included the flat tree oyster (Isognomon alatus), found on mangrove roots, two species of nerites (Nerita tessellata and N. versicolor), found on intertidal rocks, and a conch (Strombus sp.) and one of the vase shells (Vasum sp.), the latter two both found in shallow, sandy or grassy inshore areas. Some correlates were found here to collections of molluscs in the Canary Islands.

Little can be said of cooking and food preparation practices at the Convento since many of the shells in the form of burned, split, cut, and excessively fragile, leached fragments may have been discarded during excavation. Standard Old World Spanish cooking practices are hinted at by the presence of large numbers of coarse, utilitarian earthenware vessels (Council 1979:100-101) that probably served as stewpots. One early source tells us of cabbage palm cut into slices and boiled in ollas "... with all sorts of meat" (Esquemeling 1893:22). Olive jars, used by the Spanish to store oil, wine, and olives in brine (Goggin 1960) were common at the Convento. Cooking and storage methods were largely supportive of the implications regarding Old World Spanish cooking and food preparation practices.

The lack of common aboriginal wild and domestic terrestrial land animal food sources in the archeological record is not surprising, as the native population had been decimated even before the Convento was constructed. If we may believe Las Casas, Vázquez de Espinosa, Oviedo, and other chroniclers, there were virtually no Indians on the island after the first few decades of Spanish settlement. There is no other evidence of Spanish-Taino acculturation in the Convento artifact inventory, with

[illegible] exception of the manatee rib "celt" from a 16th century level, and there is only the suggestion that the Africans, who took the place of the Taino in the work force and far outnumbered the Spanish by the end of the 16th century, made their influence felt in the possible construction of certain locally-made coarse earthenwares (Council 1975: 120). Even the Africans would have been restricted to a basic diet of fish, European domestic animals, cassava, maize, fruit and other agricultural crops, and trade items as most of the native mammals and reptiles and many of the birds were extirpated by the destructive capabilities of large feral dog, cat, pig, and cattle populations.

The Convento was a part of the city of Santo Domingo and its commerce and much of the food remains that have been recovered archeologically must have originated either as gifts to the friars or they were bought in markets or from fishermen or ranchers. Maps of the 17th and 18th centuries show the Convento located at the edge of the populated area of the city near an open area of gardens (Jefferys 1970:94, Alcmar 1943 32-33), further supportive of the transfer of Spanish models of home gardens and orchards. Certainly the friars would have kept a flock of sheep, some chickens, and some cattle and pigs, but securing manatee, porpoise, fish, turtles, and molluscs must have fallen to someone else. Their primary concern was certainly not in securing the daily bread. The lack of quantities of fish remains in the refuse of a building complex which was the very symbol of Catholicism is perplexing and not necessarily a result of Goggin's sampling technique. Distribution of the limited number of fish remains gives no support to the implication of Lenten season dietary

[illegible] ...rolled for accumulations of fish bones. A 17th century [illegible] ...rer (1930:283) informs us that the king had the power in the Indies to sell the Bull of the Cruzada--which was a license to eat, but its application to the friars is unclear. The Convents was not an appropriate test of the implications regarding observable social class differences in the diet

Nueva Cadiz

Nueva Cadiz was the earliest Spanish settlement in present-day South America. Located on Cubagua Island between the north coast of Venezuela and Margarita Island, its principal function was as headquarters for a short-lived but intensive pearl fishery. The town was established about 1515, reached its peak of development between 1530 and 1535, and was destroyed, probably by a hurricane, in 1545 when the pearl fishery was in decline due to overharvesting (Rouse and Cruxent 1963:134, Goggin 1968:42). The rich pearl fisheries supported a population of Spaniards, a few African slaves, and a large number of Indian slaves who had been brought from all over the Caribbean, especially the Bahamas, as divers (Wing 1961). The low, arid desert island with no fresh water supply and scanty xerophytic vegetation was able to support such a large human population (up to 1500 persons) only through supplies sent from Santo Domingo and the mainland (Cruxent and Rouse 1958:58, Rouse and Cruxent 1963:134).

In 1954 part of a house and a number of adjacent small middens were excavated by John M. Goggin and José M. Cruxent at the ruins of Nueva Cadiz. A good sample of animal bones were recovered and formed the basis of a preliminary study by Elizabeth S. Wing (1961). Subsequent identification by Wing has expanded considerably the species list originally presented. The complete list and MNI are included as part of Table 3

Margarita (Isla de Mujeres) is probable that deer and rabbits, the only wild mammals present in the sample, came from neighboring Margarita Island seems a good possibility. There were close ties with Margarita as a part of the pearl fishery, and the size, vegetation, and water supply were much more conducive to the growth and maintenance of animal populations. This is confirmed by Vázquez de Espinosa (1968:49) who stated that " ... the whole island is overrun with rabbits," and that " ... all over the island deer are abundant ... " Margarita was also better suited for agriculture and animal husbandry: "The soil on the island is dry ... but when it is cultivated the crops bear admirably and is profusion, in fact, a fanega of corn bears 300- or 400-fold," and "There are large herds of cattle and goats on the island ... " (Vázquez de Espinosa 1968:48, 49) Cubagua Island itself apparently had much more limited resources the soil is " ... very nitrous, full of salt; there is no fresh water, and very few trees ... There are no other animals but rabbits, and some sea fowls ... " (Jefferys 1970:4)

It follows that the population of Nueva Cadiz, faced with the limited food producing capabilities of their island and working daily in and on the sea, would make heavy use of marine resources. The large numbers and variety of fish and the number of large sea turtles presented in Table 3 illustrates this heavy dependence, and the degree of use of oysters for food as a by-product of the pearl fishery can only be speculated

Fishing was concentrated in the inshore pelagic and estuarine habitats surrounding Cubagua Island Of 104 individual fish identified from 22 taxonomic groups, 80 8% (85 individuals) were from this estuarine and inshore zone. These fishes included the sharpnose shark, marine

[illegible] jacks, [illegible] porgies, trout, drum, mullet, barracuda, and puffers. Secondary fishing loci were inshore banks and reefs, grunts, snappers, hogfish, parrotfish, and spadefish made up 16.3% of the total fishes. No fish were identified that frequent offshore banks, but 2.9%, all from the mackerel and tuna family, represented the offshore pelagic habitat. Once again examination of fish remains had indicated a refutation of the implications regarding the presence of deep water, commercial fishery species in the New World as had been the pattern in Spain.

In spite of the apparent heavy dependence on marine resources, domestic animals were important to the Spaniards and the standard inventory of cow, pig, sheep/goat, and chicken are represented in addition to dog and cat. An aboriginal domesticant, the muscovy duck, is also present but it is not possible to discern if this particular case represents a Spanish adoption or part of the "baggage" of one of the aboriginal pearl divers. A very small percentage of chicken bones were from young individuals, the rest were mature, and it is again assumed that egg production was the primary purpose for keeping the chickens. Although goats are mentioned in the documents to the exclusion of sheep, the Caprinae bones cannot be further identified than sheep/goat. The single cow present in the sample was well over 42 months of age based on epiphyseal fusion, and the pigs were between six and 18 months of age, based primarily upon tooth eruption.

Wing's (1961) conclusions as to the relative importance of marine fishes, birds, and reptiles and of wild domestic birds and mammals from Nueva Cadiz were in part based on the concept of usable weight first developed by White (1953). New data on usable weights have become available since then (see Ziegler 1973), and Wing's original figures need to

[illegible] and t[illegible] the recent additions to t[illegible] species [illegible] Standard calculations of [illegible]ield meat based on MNI have resulted in [illegible] estimate of 4081 lbs for the Nueva Cadiz sample. Of this, wild terrestrial game (rabbits and deer) contributed 425 lbs or 10.4%, domestic mammals and birds 1518 lbs or 37.2%, and marine resources (including birds, fish, and turtles) 2138 lbs or 52.4%. Based on Wing's calculation of usable weight, sea turtles alone represented 41.1% of the meat diet of the Nueva Cadiz inhabitants.

The resolution of the implications as regards the Nueva Cadiz data shows a number of differences to the Convento site. These may be due to the nature of the site as a specific, one-industry colony with a great degree of Spanish-Indian interaction. The first implications, regarding Spanish agricultural models, were not applicable to Nueva Cadiz due to the lack of arable land. The second series of implications, concerning domestic animal usage, were refuted by the Nueva Cadiz data. Not only were domestic animals not the major source of meat, but these present did not reflect the expected species composition. Pigs, perhaps due to their foraging ability, were more often represented than sheep/goats or cattle. The presence of deer, rabbit, and some coastal birds in the Nueva Cadiz middens tend to support the third set of implications regarding wild animal use in Spain. The fourth series of implications, concerning transfer of fishing techniques, were refuted by examination of fish remains.

There is little supportive evidence for cooking practices. Negative evidence perhaps supporting stew-based cooking techniques is in the extremely low incidence of burned or charred bone. The implications regarding transfer of Old World cooking techniques are supported by the

presence of olive jars, and by aboriginal earthenwares, which have been shown elsewhere (Otto and Lewis 1974) to have been used by the Spanish in cooking. Any data regarding Lenten season dietary differences has been obscured by the large numbers of fish remains present at the site. Any implications regarding similarities to Old World patterns of dietary differences attributable to social class are obscured by the basic two-class system (Indian/Spanish) present at Nueva Cadiz, and will not be applicable until more information is available on the identity of specific household inhabitants.

These data are in great contrast to the foodways represented at the Convento de San Francisco, whose inhabitants relied heavily on domestic animals and very little on the resources of the sea. The difference may be at least partly reflected in the fact that at Nueva Cadiz, Spaniards and aborigines from various tribal groups worked and lived together (albeit in a master/slave relationship) for the duration of the site's occupation, at the Convento there was virtually no interaction with the aborigines, and Spanish foodstuffs were readily available in Santo Domingo. Spanish-aboriginal interaction at Nueva Cadiz is further demonstrated by the fact that of the five dogs found in the middens, three individuals are of the small West Indian aboriginal variety, and two very large individuals are probably introduced Spanish mastiffs (Lawrence and Wing MS).

Summary

The initial thrust of Spanish colonization was in the West Indies, and it was here that Spaniards first encountered aboriginal plant and animal foods. These foodstuffs were relied on at first as emergency

measures, [illegible] the inability of the major Spanish cultivated plants to adapt to the different climate and the succesful production of aboriginal cultigens became apparent, New World Spaniards adopted cassava and maize as staples. Although Ferdinand and his successor, Charles V, ordered the conquistadors to take farmers with them and experiment with Spanish crops such as wheat and barley, little came of this in the early decades (Zavala 1943 110-112). Spain had to wait until wheat became established in the more temperate areas of Mexico and the valleys of highland South America for the new colonies to become agricultural exporters In the meantime, the New World crops, corn and potatoes (the latter from highland South America), had been transported across the Atlantic to Spain, but only became established there in the 16th and early 17th centuries (Vicens Vives 1969 512, Tannahill 1973 258). This concern with the development of agriculture in the New World is in part attributable to the general view of colonies as production units supplying the mother land, and in part a more direct response to Spanish grain crises resulting from previously mentioned unsound agricultural policies favoring expansion, in particular of the sheep industry.

European domestic animals fared far better than the introduced domestic plants in the West Indies, and expansion of herds of food animals, particularly cattle and pigs, was unprecedented, changing the availability of types of meat traditionally consumed in Spain. Whereas mutton had been the meat staple in Spain, beef and pork replaced it in the Americas. There was never a need for the Spanish to adopt many of the aboriginal meat sources as they had with plant foods due to the immediate success of most

European domestic animals [illegible] have limited applicability to special cases like Nueva Cadiz. The success of livestock production was fortunate, for hunting had never been a Spanish forte.

Fish continued to be a minor portion of the diet, but an offshore fishing industry never developed as it had in Spain. The great majority of fishes caught were estuarine and inshore pelagic species, which were only a minor subsistence component of the Iberian fishing industry. Spanish fish consumption in the Caribbean area paralleled the species and habitat, if not the quantity, of aboriginal fish usage, and it is in the areas of fishing and agriculture that New World peoples really contributed to the diet of the Spanish colonists.

Crosby (1972:77) notes that in the Caribbean, the Spanish had created a perfect base camp for the assault on the mainland. When they did move into Mexico, South America, and Florida, they carried manioc bread in the saddlebags of Antillean-bred horses and brought with them "a commissariat on the hoof;" herds of swine, cattle, and goats born on the islands.

CHAPTER 4

THE SPANISH IN FLORIDA

Aboriginal Subsistence at Contact

As the early conquistadors moved out of their Caribbean island bases and searched more diligently for Tierra Firme and its rewards, a few came north and landed on the shores of Florida. They encountered a variety of aboriginal groups from the lower east and west coasts who were apparently non-agricultural hunters, fishers, and gatherers (Swanton 1946). However, evidence of corn pollen from the Lake Okeechobee Basin by A.D. 500 (Sears 1971:328-329) and pumpkin and gourd seeds from Key Marco (Gilliland 1965: 102) indicates that early ethnographic sources disclaiming aboriginal horticulture in South Florida are possibly inaccurate. Cultivated plant foods, if present, must have constituted only a minor part of the subsistence base. These groups ranged from loosely organized tribes of Ais, Jeaga, Jobé, and Tequesta to the highly stratified Calusa on the southwest coast and their Mayaimi affiliates in the interior (Goggin and Sturtevant 1964:180-182).

The Spaniards were more impressed with the subsistence base of the aboriginal groups in the northern part of the state, the Apalachee west of the Aucilla River and the Timucua to the south and east were corn-beans-squash agriculturalists who supplemented their diet with hunting and fishing. In fact, DeSoto's expedition in 1539 was saved from possible starvation by their arrival in Apalachee at the approximate time of harvest of the aboriginal cornfields.

> [illegible] [illegible] [illegible]

Swanton (1946 308-309) cites Laudonnière, Calderón, and LeMoyne in his characterization of Timucuan agriculture, which he further describes as a two crop system (citing Weahold 1936) with a burning of the week and brush cover from the old fields in January, followed by the first planting in March or April and the second, on the same field, in June. Fields were initially prepared with hoes and the grain or beans planted in a hole made with a digging stick. There are indications that this simplistic view of efficient agriculture is incorrect. Swanton's description would indicate sedentary, full-time agriculturalists, yet we know from documentary research (Milanich MS ; Deagan MS) that the Timucua were seasonal agriculturalists, perhaps best described part of the year as central-based nomads.

The archaeological record has suggested a somewhat different interpretation for at least the coastal sector based on analysis of plant remains from the Gumis site of Pine Harbor in coastal Georgia. Larsen (1969 293) and others (Sauer 1971 212) have interpreted the presence of old field pioneer species in with remains of cultigens in archaeological sites as suggesting shifting cultivation; in other words, an old field lay fallow long enough for persimmon, grape, and cherry to invade before being cleared and planted again. Presumably these species were also desirable and would have been left in subsequent clearings of the field, which would be cropped for a few years before lying fallow (Larsen 1969 302). A mixed crop of corn, beans, and squash in the same field would help soil fertility and reduce the need to relocate villages as frequently due to regional soil depletion

Larson (1969:307) also contends that agriculture in the northeast Florida-southeast Georgia coastal sector was of a different magnitude than in the Apalachee area, due principally to the widely differing soil fertility and generally poor drainage in the area between the pine barrens and the coast. Based on the analysis of the Pine Harbor site and his reading of the ethnohistorical sources, Larson (ibid) suggests that agriculture was not of "primary subsistence importance" and that wild plant foods, generally nuts, persimmons, grapes, plums, and berries, were more important. He figures a contribution to the diet by hunted and gathered animal resources at an average of perhaps one-third of the total daily caloric intake per individual (Larson 1969:317-321).

Previously the richest source for Timucuan agricultural practices was considered to be the Theodor de Bry engravings of original paintings by Jacques LeMoyne (corrected in Lorant 1965) More recently the accuracy of the engravings has come into question (Hulton and Quinn 1964, Sauer 1971, McPhail MS.). We must keep in mind that the engravings were adapted by De Bry from paintings made by LeMoyne 20 years after he returned from Florida, and that all but one of the paintings are now lost and thus cannot be compared with the engravings. In addition, LeMoyne himself was not present at some of the episodes he portrays, and when De Bry started work on the engravings he had just completed a series for Hans Staden on the Aborigines of Brazil. There are many similarities between the DeBry renderings of LeMoyne's and Staden's works (McPhail MS) Four of the engravings which pertain to Timucuan subsistence practices are reproduced here (Figs 2-5)

[illegible] engravings are [illegible] (or [illegible]) introduced by natural or human agency long before the Spanish arrival), although there are suggestions that the engraver may have filled in his squash and fruit baskets with at least some European cultigens (Figs. 2, 4). Another fact to remember is that by 1590, Europeans had been introduced to New World cultigens for nearly a century, and corn, squashes, and peppers were being brought back and grown in Europe. Of interest is the relatively high proportion of squash to maize suggested in the engravings, and the ratio of meat to plant foods in the aboriginal diet. A fifth engraving, from one of John White's watercolors, is added as an example of both aboriginal and contemporary (1585) European cooking techniques (Fig. 6).

Archeological excavations in northeast Florida aboriginal sites have clarified the contribution to the diet of various wild animal food sources. Examples chosen here are Summer Haven (8SJ-46), a late Archaic site in St. Johns County, Florida, immediately south of Matanzas Inlet (Bullen and Bullen 1961), and the Goodbread mound and midden (8Du-66), a protohistoric to early historic period site situated on a hammock on the shore of Mill Cove off the St. Johns River, seven miles west of the Atlantic and 30 miles north of St. Augustine (Wing 1963). Vertebrate species are listed in Table 4, and while invertebrates were important, particularly at Summer Haven site, lack of information on the presence of species and number of individuals precludes their proper listing. Oysters, coquinas, and Mercenaria clams were the most common shellfish at Summer Haven. Table 4 also includes materials from San Juan del Puerto (8Du-53), an historic period aboriginal village and Spanish mission (doctrina) which will be discussed later in greater detail.

FIGURE 2 Theodor De Bry engraving, "The Natives of Florida Worship the Column Erected by the Commander on His First Voyage," from original painting by Jacques LeMoyne First published in 1590, this figure is reproduced from the 1965 edition of Stefan Lorant The New World The First Pictures of America (New York Duell, Sloan and Pearch) Used by permission

In addition to obvious European touches such as the muskets, the engraving features recognizable pre-Columbian aboriginal cultigens such as maize, beans, and other squash varieties, gourds (Lagenaria sp.), possibly beans, and what may be wild persimmons or Chickasaw plums. Not as clear in the engraving but hinted at more strongly in the one surviving painting attributed to LeMoyne are what may be European cultigens such as a turnip, pear, and fruits like peaches or Damson plums (see in Lorant 1965, Hulton and Quinn 1964, pl. 145). An additional disclaimer to this scene is that it took place in 1562, while LeMoyne didn't arrive in Florida until 1564

FIGURE 3 Theodor De Bry engraving, "Storing Their Crops in the Public Granary," from original painting by Jacques LeMoyne. First published in 1590, this figure is reproduced from the 1965 edition of Stefan Lorant's The New World: The First Pictures of America (New York: Duell, Sloan and Pearce). Used by permission.

The stylized or European-made dugout canoe contains European baskets filled with squashes of several varieties, a mound of maize ears, and other more speculative crops or gathered foods. The wattle-and-daub and thatch granary fits other contemporary descriptions of Timucua buildings, although the original caption indicates stone and earth construction, which is not aboriginal construction technique in Florida.

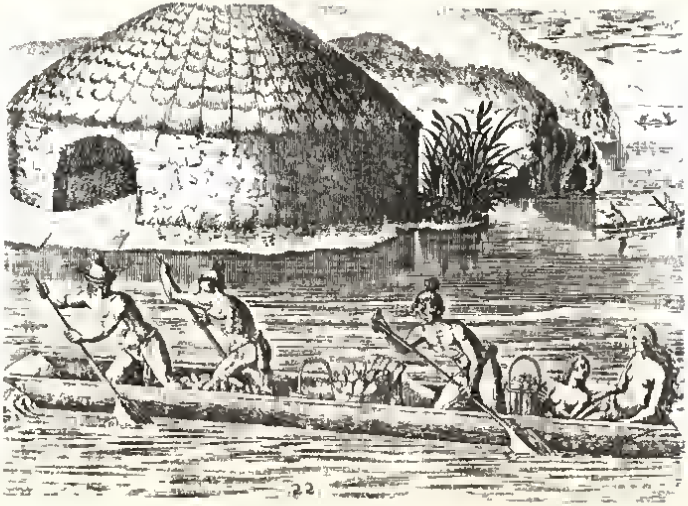

FIGURE 4. Theodor De Bry engraving, "Bringing in Wild Animals, Fish, and Other Stores," from original painting by Jacques LeMoyne. First published in 1590, this figure is reproduced from the 1965 edition of Stefan Lorant's The New World: The First Pictures of America (New York: Duell, Sloan and Pearce). Used by permission.

Ignoring the dramatic postures of heavy-bodied Renaissance women, we can recognize baskets of various squash varieties, one which looks suspiciously like a basket of apples (a European cultigen), an armload of fish, and one or more baskets of assorted fish, reptiles, and mammal fore- and hind-quarters, at least one of which is an artiodactyl, presumably a deer.

FIGURE 5. Theodor De Bry engraving, "Drying Meat, Fish, and Other Food," from original painting by Jacques LeMoyne. First published in 1590, this figure is reproduced from the 1969 edition of Stefan Lorant's The New World: The First Pictures of America (New York: Duell, Sloan and Pearce). Used by permission.

The classic example of aboriginal meat cooking and preservation techniques. None of the animals seems to have been eviscerated and the rattlesnake (?) and alligators are unskinned, making the illustrated technique rather ineffective. One cloven-hoofed mammal is apparently a deer, and a dog or possibly a fox may be the best guess for the other mammal pictured. The fish are of several species although none are recognizable. De Bry may have "borrowed" this view from work he did for Hans Staden on the aborigines of Brazil. Staden's drying or smoking rack is virtually identical except that it holds severed human limbs (MacPhail MS).

FIGURE 6. G. Vaen engraving, "How They Boil Meat in Earthenware Pots," from original watercolor John White. Originally drawn by White in 1585 and published in this form by Theodor De Bry in 1590. Reproduced from the 1965 edition of Stefan Lorant's The New World: The First Pictures of America (New York: Duell, Sloan and Pearce). Used by permission.

The engraver has added the aborigines, made the fire largely of trimmed wood, and has added quantities of smoke to the fire and a fish to the pot, which originally contained an ear of maize and unidentified objects (Hulton and Quinn 1964). The accompanying caption (by Hariot, not White) is perhaps as indicative of European cooking as aboriginal:

> Their women have the greatest skill in making large earthen pots, which are so fine that not even our own potters can make any better. These are carried around from place to place just as easily as our own brass kettles. They set them up on a pile of earth and then put wood underneath and kindle it, taking great care that the fire burns evenly on all sides. They fill the pot with water, then put fruit, meat, and fish into it, and let it boil together as in a gallimaufry, which the Spaniards call olla podrida.
> (Lorant 1965:255)

Although similar cooking practices are noted from Florida, this scene depicts Carolina Algonquian peoples (William C. Sturtevant in Hulton and Quinn 1964).

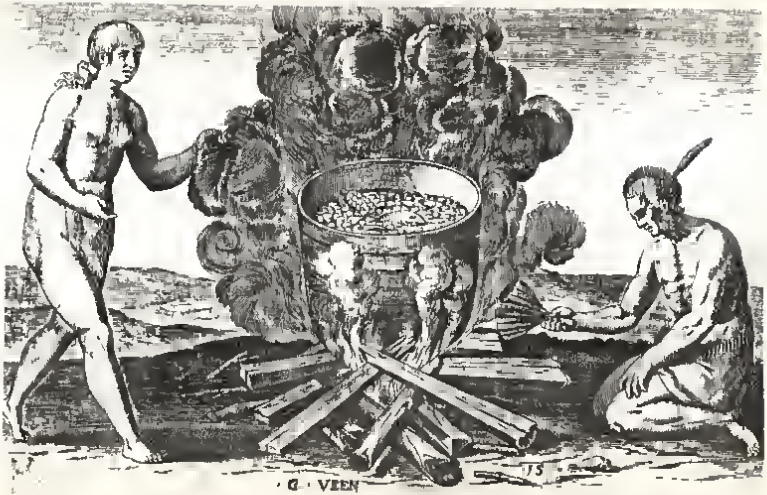
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Table 4 Vertebrate Species Represented by MNI, Northeast Florida Aboriginal Sites

Species	Summer Haven	Goodman Site	San Juan del Puerto
MAMMALS			
Didelphis marsupialis Opossum	7	2	1
Blarina brevicauda Short-tailed shrew		1	
Sylvilagus sp. Rabbit	11	5	3
Sciurus carolinensis Gray squirrel		2	
Sciurus niger Fox squirrel		1	
Sigmodon hispidus Cotton rat		4	2
Rattus cf. R. rattus Black rat		1	
Cetacean Whale or porpoise		6	1
Delphinidae Porpoise	2		
Canis familiaris Domestic dog	7		3
Ursus americanus Black bear			2
Procyon lotor Raccoon	13	7	1
Lutra canadensis River otter			1
Mustela frenata Long-tailed weasel		2	

Table 4. Continued

Species	Summer Caves	Goodman Site	San Juan del Puerto
Felis concolor Florida panther		3	
Sus scrofa Domestic pig			3
Odocoileus virginianus White-tailed deer	19	10	4
Bos taurus Domestic cow			1
BIRDS			
Gavia immer Loon	2		
Colymbus auritus Horned grebe		1	
Morus bassanus Gannet	2		
Phalacrocorax auritus Double-crested cormorant		4	
Aix sponsa Wood duck		1	
Lophodytes cucullatus Hooded merganser		8	
Mergus cf. M. serrator Red-breasted merganser		24	
Anatidae Duck			1
Gallus gallus Domestic chicken			1
Meleagris gallopavo Turkey	1		1

Table 4 Continued

Species	Summer Haven	Goodman Bath	San Juan del Puerto
Rallus sp. Rail		1	
Catoptrophorus semipalmatus Willet		1	
Larus argentatus Herring gull		1	
Fanguinus immensis Great auk	1		
Uria aalge Common murre	1		
Corvus ossifragus Fish crow		1	
Passerine Perching bird			1
REPTILES			
Chelydra serpentina Snapping turtle		1	1
Kinosternon baurl Striped mud turtle		3	
Kinosternon sp- Mud turtle	1		1
Chrysemys sp Pond turtle	6	4	1
Deirochelys reticularia Chicken turtle		2	
Malaclemys terrapin Diamondback terrapin			2
Terrapene carolina Box turtle	3	3	1

Table 4. Continued

Species	Summer Haven	Goodman Site	San Juan del Puerto
Gopherus polyphemus Gopher tortoise	12	2	3
Chelonidae Sea turtle	12	1	2
Trionyx ferox Softshell turtle	4	4	
Drymarchon corais Indigo snake	3		1
Viperidae Pit viper	6		
Alligator mississipiensis Alligator		1	1
FISH			
Unidentified ray	1		
Scyliorhynoid shark	13		
Galeocerdo cuviera Tiger shark	1		
Lepisosteus sp Gar			1
Amia calva Bowfin		1	
Arius felis Sea catfish	8	4	4
Bagre marinus Gafftopsail catfish		10	2
Ariidae Sea catfish	5		
Ictalurus sp Catfish		3	

Table 4. Continued

Species	Summer Haven	Goodman Site	San Juan del Puerto
Centropomus sp. Snook	1		
cf. Micropterus salmoides Largemouth bass	3		
Pomatomus saltatrix Bluefish	3		
Lutjanus sp. Snapper	1		
Archosargus probatocephalus Sheepshead		5	3
Sparidae Porgy		5	
Cynoscion sp. Seatrout	1	1	1
Pogonias cromis Black drum	1	4	3
Sciaenops ocellata Red drum	31	9	5
Sciaenidae Drum	2		1
Mugil sp Mullet			3
cf. Trichiurus lepturus Cutlass fish	5		
cf. Paralichthys sp. Flounder		1	
Total MNI	189	150	63
Total Number Species	33	40	33

Cultural Exchange of Plants and Animals

The Spaniards arrived in Florida with at least two decades' experience with Caribbean aborigines and their food supply. They were familiar with and made heavy use of the New World crops cassava, maize, and to a more limited degree, squash and beans. Other than fish and an occasional manatee or crocodile, native meat sources failed to interest the Spanish and they brought to Florida their own familiar pigs, sheep, and cattle.

None of the early forays into Florida, those of Juan Ponce de León in 1513, Pánfilo de Narváez in 1528, Hernando de Soto in 1539, or Tristán de Luna in 1559, made any significant changes in aboriginal foods or food procurement or production techniques. Pedro Menéndez de Avilés brought maize to the Calusa in 1566 (Lyon 1973), but it apparently did not become a subsistence crop. The general hostility of the aborigines prevented any continued efforts at European settlement and subsequent introduction of livestock and cultigens. Certainly some livestock escaped, for de Soto and others had brought with them hundreds of animals, but these "introductions" had no major effect on aboriginal subsistence.

Tribes that were non-agriculturalists at the time of the Spanish arrival apparently continued on a hunting-gathering subsistence base as long as they remained viable entities. One of the classic descriptions of aboriginal groups on the east coast of Florida was written by Jonathan Dickinson (1945), shipwrecked at Jupiter Inlet in the fall of 1696. Dickinson and his party survived several hungry months among various coastal tribes eating palmetto berries, coco-plums, sea grapes, clams, and fish, and it was not until they reached the vicinity of Cape Canaveral that any aboriginal cultigens were observed (Dickinson 1945:69). These

tribes had been in sporadic contact with the Spanish for over a century. Any real acculturative changes had to await the establishment of long term contacts between aborigines and Spaniards, a situation that did not exist in Florida until after the founding of St. Augustine in 1565.

The most successful aboriginal-Spanish contacts came later, during the 17th century, when the Franciscans, following a brief and unsuccessful Jesuit attempt, began the establishment of a chain of mission villages stretching from St. Augustine on the east coast through Timucua territory starting in 1606, and well west into Apalachee by 1633. The Spanish policy of dealing with the aboriginal inhabitants of the New World had changed in the early decades of the 16th century, too late to help the majority of the Caribbean peoples. There were no mines in Florida, no centers of manufacture, no large haciendas or plantations, and there were strict provisions against an encomienda policy with forced native labor.

Spanish policy toward the aborigines in North Florida was the establishment of the mission system, north along the coast and west into Apalachee, a strategem which was morally justifiable in that aboriginal souls were saved through conversion to Christianity, and progress was made into the richer agricultural lands of the interior, both of which acted to strengthen the security of the fledgling colony of St. Augustine (Boyd, Smith, and Griffin 1951:6).

The mission period in Florida was the only real directed contact situation (Spicer 1961) in which the Spanish, as members of the superordinate society, applied sanctions to enforce change in the culture of the aboriginal, subordinate society. These sanctions were chiefly of an

ecclesiastical nature (Spurtevant [illegible] 63) and were administered peacefully by the missionaries. Only in a limited sense were changes of an economic nature designed to benefit the Spanish, but the priests did oversee changes in aboriginal agricultural techniques and hoped to improve the land and the harvests by implementation of European tools and methods (Gannon 1965:55-56)

The concept of the missions as production units for the garrisons at St Augustine and later St Marks, Pensacola, and San Luis is incorrect (Matter 1972), although Indians were used as laborers on neighboring ranches and farms It is clear from the documents that the aboriginal populations at the doctrinas and visitas were producing for themselves and the friars, though vegetables and livestock were occasionally sold to soldiers and colonists In 1700, Governor Zúñiga clarified the matter of personal property rights among the aborigines, stating "[illegible] they (are to) be allowed to raise their swine and fowl [illegible]" (Boyd, Smith, and Griffin 1951:31). A 1699 letter to the Spanish Crown from several Apalachee caciques complained of the damage to their fields by cattle, swine, and horses from nearby Spanish-run ranchos (ibid., p. 24, 28). Swine, chickens, and vegetables raised by the Indians and maize and beans from the Franciscans' fields were sold in St Augustine's market to benefit the missions effort which was always short of money and materials (Matter 1972:156) Friars often had their own gardens and fruit trees, growing such items as sweet potatoes (Caribbean imports), peaches, figs, and citrus (Bonifacio 1971:126)

There were violations to the official policy of Indian rights and Indian land, however The use of Indian labor on cattle ranches and wheat

and corn farms without compensation against official Spanish policy was one of the causes of the rebellion of 1656, according to Manuel, chief of Asile in western Timucua (Milanich MS). Spanish military officials were also charged by Manuel with taking land for themselves by misrepresenting the Spanish government position.

In spite of these violations of official policy, the documents indicate a more lenient attitude toward north Florida tribes than that shown in the Caribbean, and also record the shift in aboriginal subsistence techniques and settlement pattern, principally in the addition of small domestic animals to the former agricultural economy supplemented by hunting and gathering, and in the year-round residence pattern at the mission villages. One of the most difficult tasks of the priests was apparently keeping the Timucua settled in one place for the entire year. Milanich (MS.) has argued persuasively with documentary and archeological support that major acculturative changes of this nature occurred over roughly a 25-year period, with the new generation becoming more sedentary and relying more on agricultural produce. The "thin" nature of most mission village sites in the Potano area (roughly Alachua County) after 20-30 years of contact is seen as a possible reflection of short-term village occupation due to soil depletion from more intensive agriculture (ibid.).

The degree of acculturation of some of the Christian Indians at the missions is indicated by Father Oré's account of their bartering deerskins for wax to bury their dead (candles ?) and purchasing small bells for their churches with maize and pigs (ibid. p. 135). The aborigines' success with domesticated animals is indicated by the ability of one Manuel Solana, at the request of the Governor of St. Augustine, to supply him with 50 chickens on relatively short notice from the Apalachee village

him with 50 chickens on relatively short notice from the Apalachee village of Ivitachuco (Boyd, Smith, and Griffin 1951 41)

The changes in the subsistence base are further documented by Jonathan Dickinson's arrival in late 1696 at the aboriginal mission villages north of St. Augustine, which was in marked contrast to his earlier desperate plight among the non-agricultural groups on the lower east coast of Florida. At Santa Cruz the travelers were provided with cassina and a dish of boiled corn, peas, and other vegetables, at San Jose del Puerto they noted large numbers of pigs and chickens and the abundance of corn, and at Santa Maria their dish of corn and peas was seasoned with garlic and peppers (Dickinson 1945:88-90). The garlic and possibly the peas were European cultigens, and the peppers, while a native American domesticant, were probably imported by the Spanish from Mexico or the West Indies.

San Juan del Puerto, a doctrina on Fort George Island just north of the St. Johns River and probably occupied during Dickinson's visit by Guale peoples, has been partially excavated, giving additional clues to the nature of Spanish-aboriginal aculturation of foodstuffs. Recovery of a metal hoe blade suggests that the cornfields noted by Dickinson were tended with European tools rather than the aboriginal bone, wood, or shell hoes noted by Laudonnière and LeMoyne (McMurray 1973 60). A metal hoe fragment was also recovered from the probable mission site of Santa Catalina at Fig Springs (Deagan 1972 37). Other European tools available to Indians from farms and ranches near the mission village are listed in the appendix, which is an inventory of a mid-17th century Spanish wheat and cattle farm in Western Timucua. The presence of European fruits, but not

necessarily their growth at the site, is indicated by the recovery of peach pits from midden levels. Several seeds referable to the melon or squash family, Cucurbitaceae, were additional New World cultigens identified during analysis of the faunal remains. Other cultigens recovered from mission sites include corn, gourds (ibid., p. 39), and wheat (Charles H. Fairbanks, personal communication). Vertebrate species identified from San Juan del Puerto are listed in Table 4.

Fishes identified from the site are exclusively estuarine with the exception of one gar, a freshwater species which frequently enters low-salinity estuaries. We are indebted to Father Pareja, the priest assigned to the mission of San Juan del Puerto in the early 17th century, for information on the fishing techniques of the then Timucua inhabitants. Pareja, in his 1613 Confessionario, several times mentions the use of fish traps (Milanich and Sturtevant 1973:24). The one porpoise recovered probably could not have been taken in a trap or weir and may have been speared or stranded in shallow water (Larson 1969). Turtle species present indicate freshwater, estuarine, beach, and inland collecting. Birds included the domestic chicken as noted by Dickinson, and a number of domestic mammals, chiefly pigs, are represented. It is estimated that the domestic animals represent approximately half of the meat intake indicated by the excavated sample. Bear remains, particularly paws, were present and it is interesting to note Pareja's referral to women annointing their heads with bear grease (ibid., p. 28). Oysters were present in small middens throughout the site. Cotton rats are typically agricultural pests and may indicate animals caught around the village storehouse or granary (Dickinson 1945:88). Dogs were apparently common around

the village, and the presence of one very large [illegible] Cadiz, probably indicates a dog of Spanish descent

Timucuan settlement and subsistence patterns appear to have changed rapidly in response to successful Spanish mission policy after about 1630 and increased population influx from aboriginal groups in Apalachee, coastal Georgia, and from other Timucua areas after the middle of the century (Milanich 1972:60, MS., Deagan MS.). These changes are discernible archeologically in the periodic relocation of village sites, presence of greater quantities of corn in sites, increased use of metal, and changes in the shape of aboriginal ceramic vessels reflecting European "templates" (Milanich MS.). These changes were also accelerated by the presence in the western Timucua area of Spanish farms by the 1640's (Deagan 1972:40) and cattle ranches by 1655 (Arnade 1961:6) which utilized aboriginal labor from nearby mission villages.

Primary Spanish contact with both the Apalachee and Timucua in the 17th century was through the mission villages, and acculturation in the form of directed change was on a village level. It was only after the Spanish priests introduced new tools and intensive agricultural techniques that aboriginal crops became dependable enough to allow year-round occupation of the mission villages (Milanich MS.). The role of large numbers of immigrant Guale and Yamassee peoples in changing Timucua agricultural techniques after the middle of the 17th century is not known (Deagan MS.), but many of these peoples had also been influenced by Spanish priests at the coastal missions north of St. Augustine

St. Augustine The First Spanish Period

By the time the Spanish settled in Florida in 1565 at the place on the northeast coast which they called San Agustín, the New World had been under European scrutiny and eventual domination for better than 70 years St. Augustine had been chosen and continued in its role as a defense post, first to ward off French incursion and then to act as a northern buffer against English military encroachments and guard the northern end of the Bahama Channel, the pipeline by which the riches of the New World sailed on galleons headed back to Spain.

The site and not been chosen for its agricultural potential, and it is hardly surprising that the early colonists had great difficulties in their initial food production efforts. Much of the information on the difficult early years of St Augustine comes from an investigation made in Madrid in 1573 by licentiate Gamboa on matters concerning Florida, a summary of depositions to the King from the settlers of Santa Elena (on the South Carolina coast) made in 1576 and 1577 (Connor 1925 83-101, 145-185), and recent investigations by Charles Arnade (1959a).

We know that Pedro Menéndez de Avilés, the Adelantado of Florida, fully intended to set up a flourishing colony and brought with him large quantities of seed and many domestic animals, in addition to farmers, blacksmiths, carpenters, stonecutters, and men of other trades to supplement the military force. The asiento, or contract between the Crown and Menéndez, had called for an additional 400 settlers (of which at least 100 were to be farmers) to be brought over within three years to found viable agricultural settlements, with farmsteads clustering around the villages, and the town as " .. the spearhead for the advance of Castilian

civilization (Lyon [illegible]) The basic labor force was to be [illegible] who were to be engaged chiefly in sugar production, further economic benefit was to be derived from livestock for hide production (ibid.). This contract must have been based on the assumption that Florida would be similar to the West Indies in its production of economic plant and animal species. Nevertheless, several witnesses agreed that " . . . at the beginning, which was two years after this witness went there, as many as 20 horses and mares were brought, and 12 cows, 40 hogs, 30 goats, and a few sheep, which was all consumed and eaten because of the famine and want that occurred, and the Indians killed the hogs . . . " (Comaor 1925:93). Another witness revealed that " . . . the soldiers of the said fort of St. Augustine were sometimes given rations of biscuit, maize, flour, jerked beef, wine when there was any, oil, and other things when they were to be had, and when there was nothing they ate herbs, fish, and other scum and vermin, which state of things lasted a long time . . . " (ibid., p. 99). Menéndez brought in periodically from Cuba and the Yucatan peninsula rice, beef and pork, garbanzos, sides of bacon, fish, beans, cheese, maize, honey, and cassava in addition to cattle, horses, pigs, sheep, goats, and chickens (Lyon 1973:161, 240, 314-315), but Menéndez' troubles with ships, personnel, and the authorities kept the line of supply thin and times were hard for the early Spanish inhabitants of St. Augustine.

The early settlers were discouraged and many of the farmers who had been brought over grumbled and complained of broken promises.

> [illegible] many perquisites were promised to all those who should come to settle these provinces, as is set forth more at length in the said ordinance: giving me all manner of cattle, twelve head with the bull, establishing

> us on good soil, and giving us allotments of lands for farming and raising cattle. And nothing of this has been fulfilled to us, unless it be to keep us on an island surrounded by sea water, which is one league long and half a league wide, more or less, the larger part of which island, at every period of spring tides, is overflowed by the sea, and the land is of the kind aforesaid, and we have no other assistance save our own arms, although by doing some hoeing we have broken up a little land which we sow with maize to sustain our children, because the soil is not of the quality for sowing any other sort of (grain for) bread, as a little wheat and barley sad been planted there by hoeing and after having headed badly, there is nothing to it but the husk. Besides which, even if the soil were rich and fertile, it sad not the (right) climate nor is the earth ever dry, unless it be with the frosts and extreme cold caused therein by the winter, which comes in December and January, for in the months of April and May, when the (grain for) bread ripens in this island, it does nothing but rain all the time, which is when we are sowing and gathering the maize, and so we have suffered and do suffer great hardships, as the harvest is small which we gather therefrom with excessive labor, because the agreement with us has not been carried out, as has been said. Therefore we have wasted all our means, with which, and among other things, we came well supplied, having been farmers in Spain, where we had all manner of cattle wherewith to work, and so here we find ourselves lost, and old, and weary, and full of sickness. Even though some of the settlers themselves have brought cattle, it sad not been possible to increase or preserve it save at great cost, in feeding them from the little maize we gather, and because of all the aforesaid, we say, as we have said, that we have grown useless, old, tired and sick, and have been ill-treated and insulted by the governors who have governed, and so we say that, on account of the reasons already given, are not for settling (here) (ibid., p 147-149)

Although this particularly harsh criticism was meted out by a citizen of Santa Elena, it mirrors complaints of St Augustine itself

St. Augustine, in spite of its location on nutrient-poor coastal soils, was expected to grow most of its own food. The Council of the Indies and Philip II, in appointing Gonzalo Méndez de Canzo as Governor in 1596, charged him with developing cultivation at St Augustine and

threatened the loss of a portion of his salary if he neglected agricultural development (Geiger 1937:72). In spite of this incentive, times remained hard for the inhabitants and fishing, gathering shellfish, and a helping hand from friendly Timucuans were necessary to avert starvation (Arnade 1959a:30; Geiger 1937:79). The documents are quite clear regarding the tenuous nature of subsistence in St. Augustine in the early years. A letter from Governor Canzo to the King in February, 1600, warns of threatening famine and indicates that he was exhorting the soldiers to till the land in order to produce sufficient grain to feed the growing populace, among whom were many children (Geiger 1937:123).

Even before Canzo's tenure as Governor it was clear that St. Augustine needed help. The response to this need was the situado, a once-yearly supply ship from Mexico, transshipped by way of Cuba. The situado had been initiated following the death of Pedro Menéndez de Avilés in 1574. In theory the situado was payment to the garrison at St. Augustine, charged against the Viceroy of New Spain, for St. Augustine's role in protecting cargo ships at the north end of the Bahama Channel, and for patrolling the coast and giving aid to victims of shipwrecks. The situado was composed of cash, foodstuffs, and material goods in specific amounts determined by the number of soldiers in the garrison, and not the number of dependents and other inhabitants in St. Augustine. Unfortunately, arrival of the situado on time was something of a rarity, and it was not unusual for men of the garrison to remain unpaid for periods of up to several years. At least two 10-year periods went by without the arrival of the supply ship (Matter 1972:143). In 1696 when Dickinson and his party arrived in St. Augustine, he learned that the situado hadn't arrived in three years (Dickinson 1945:83).

[illegible] problems even when it did arrive, for there were numerous opportunities for graft and speculation which raised the price of goods tremendously. A 1700 letter from Fray Alonso de Leturiondo to the king cites numerous instances of extreme mark-up on foodstuffs: sugar, per box, 20 pesos in Havana, 100 pesos in St. Augustine; an arroba of pepper, 6 pesos in Havana, 100 pesos in St. Augustine (St. Augustine Historical Society 1961:6). Other items such as wine, rice, and cinnamon were similarly priced. The common soldiers, and particularly married men with families (they received no extra stipend for dependents) were constantly in debt and had to subsist on local resources (Chatelaine 1941b 22).

The cultivation of plant foods by the impoverished inhabitants was no easy task. The immediate area of St. Augustine is characterized by exceptionally low relief and a geologically immature drainage system with swamps and marshes parallel to the coast, separated by intervening low ridges (Boniface 1971:19). These ridges of acidic, sandy soil generally have an underlying hardpan resulting from excessive leaching due to heavy rainfall (Bryant 1958:25) and are characterized by a growth of pine and palmetto which are replaced by hardwoods in better drained areas. The combination of soil type and rainfall is not conducive to non-fossil fuel agriculture as the porous soil retains little moisture in the winter dry season and is often sodden in the summer.

The St. Augustine area is illustrated in Figure 7, with particular attention being given to the extensive salt marsh areas which were an additional limiting factor to cultivation throughout the Spanish occupation. Growth of the city to the west was impeded by the small but marshy creek

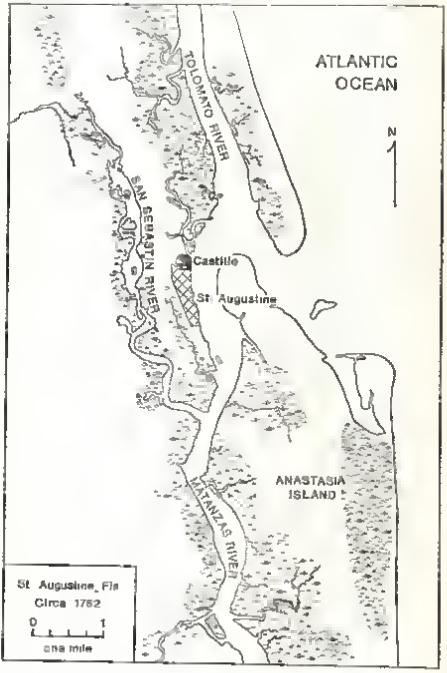


FIGURE 7- St Augustine area near the end of the 1st Spanish Period

known as Maria Sanchez, [illegible] of the town's agricultural fields were between this small waterway and the larger San Sebastian River. The area is low enough so that floods (associated with hurricanes?) in August, 1674, October, 1696, and September, 1707, contaminated St. Augustine's water supply and damaged crops, orchards, and buildings (Monifacs 1971 70).

The Spaniards persevered, however, and the agricultural progress of St. Augustine can be noted through a series of maps dating back to the 16th century. The Mestas map of 1593 shows about 10 clearly defined fields and one other which is obviously an orchard (Chatelaine 1941b, map 4). By 1737, Arredondo's "Plan de la Ciudad de San Agustin de la Florida" shows many more smaller fields, a much larger area under cultivation, and all of the available land not designated as marsh is plowed (?) rows, thus making some very small irregularly-shaped fields (ibid., map 10).

The most informative of the maps for agricultural information is the Castello map of 1764, prepared by the Spanish government for the use of the English government in accordance with the terms of the Treaty of 1763 to facilitate the transfer of Florida to England (ibid, map 13, note on p. 162). This map is apparently accurately drawn, is scaled, and shows virtually all the area under active cultivation by the inhabitants of St Augustine at the close of the 1st Spanish period, when raids by Creeks and English had bottled the Spanish up to an area within some two miles of the castillo. In the Castello map fields interlock to fit the available land, but are square to rectangular where possible. This would seem to support one of the implications concerning transfer to the New World

of Old World Spanish agricultural models. All fields appear [illegible] and the direction of rows is only consistent within one field, perhaps supporting Catelaine's statement that there was not enough cultivable land in any one spot to organize traditional European cooperative farming techniques (ibid., p. 15). Regardless of interpretations, the map shows six major areas of cultivation, including Anastasia Island, with a total of 198 individual fields averaging 1.5 hectares (3.8 acres), or a total area of field cultivation of 305 hectares (755 acres).

Of course there were household gardens and orchards as indicated in Figure 8, but while they produced a great variety of foods, the quantity could not have been enough for major dietary input. European (and Asian and African via Europe) fruit and vegetable species grown in St. Augustine included white and black figs, pomegranates, lemons, limes, nitrons, several varieties of orange, plums, peaches, quinces, grapes, pot-herbs, rice, peas, onions, garlic, greens, lettuce, radishes, plantains, and watermelons. Mesoamerican, South American, or Caribbean crops introduced by the Spanish included sweet potatoes, tomatoes, guavas, and pepers. Local aboriginal crops incorporated into the diet were corn, beans, and cucurbits such as squash and pumpkins (Dickinson 1945:84; Bartram 1942:53, De Vorsey 1971:204, Smith 1970 Appendix A, Arnade 1959a:27; Romans 1962:123, Solana 1760).

One of the real successes of Spanish food production in Florida came with the establishment of cattle ranches in the interior in the mid-17th century. The pacification of the Timucua and the Apalachee and the large role played by the missions in fostering and maintaining the peace and productivity of the hinterlands no doubt allowed this development

FIGURE 8 Plan of the Town of St Augustine, the Capital of East Florida. This copy reproduced from the 1777 edition of Thomas Jefferys and printed in London for W. Faden. Originally published 1769 by William Stork in The Description of East Florida (London) (P.K. Yonge Library of Florida History catalog number 972).

This map by Jefferys is a copy of a larger map by Don John de Solis, "A New and A[illegible] Plan, of the Town of St Augustine, Engrav'd from the Survey of Don John de Solis, [illegible] veyor, Who Resided There near Twenty Years" (1764), the original of which is in the Library of Congress.

Some of the agricultural fields are visible across Maria Sanchez Creek, although this map does not show the number of fields depicted in the Castello map of the same year. Note the number of household gardens and orchards, as well as the fortified defensive lines.

PLAN of the TOWN of

ST AUGUSTINE

the CAPITAL of

EAST FLORIDA.

SCALE

Printed for W. Faden, Charing Cross

Although there [illegible] about the early cattle industry and in particular its [illegible] supplying St Augustine with beef, it is known that there were by 1700 three major cattle-ranching areas in north Florida: (1) along the St Johns River in the vicinity of Palatka, (2) in Apalachee territory surrounding Tallahassee, and (3) in Alachua County centered at Gainesville (Arnade 1961:5)

The largest of the ranches was La Chua near Gainesville, which paid tax in 1698 and 1699 on 770 head, or nearly half the total cattle on which taxes were paid (ibid., p. 9). In addition to a 10 percent yearly (or bi-yearly?) tax payable in cattle, Governor Zúñiga inaugurated a system by which each ranch owner was assigned certain days in the year when he was required to bring five head in to St Augustine's slaughterhouse (ibid.).

Also in the rich interior lands were scattered farms or plantations, about which even less is known, although aboriginal labor from nearby mission villages was used in crop production. Corn, wheat, and beans were the major crops. Most of these farms were in Apalachee or western Timucua, although some production occurred along the St. Johns River. Tentative figures suggesting 3,000-4,000 bushels of maize and beans being shipped annually from Apalachee to St. Augustine in the mid-17th century (Gray 1933:109) would indicate successful production. Shipments of this magnitude would have provided three-quarters to one-half pound (.34-.23 kg) per person per day of corn and beans to an estimated St. Augustine population of 750-1000 (population estimate from Dunkle 1958:9)

[illegible] Ruiz de Salazar Vallecilla's wheat and corn farms and cattle ranches near the village of Asile, east of the Aucilla River on the Timucua-Apalachee "border," has been translated and forms an appendix to this paper (A.G.I. Escribanía de Cámara, Legajo 155(B) #11). The document is an inventory of the contents of the farm of the late governor, drawn up by his successor prior to the farm's being purchased by the crown to aid in the support of St. Augustine. The purchase is justified in the document by writing of the hazards of dependence on the situado: "Therefore when the supply does not come, many perish of hunger and others go in desperation to hunt the beasts of the woods .. ." Of immediate interest to this discussion are entries for 22 large team oxen, 8 horses, 45 head of swine, 13 used iron plowshares, 4 fish hooks, one African slave, one mulatto slave (the overseer), 30 fanegas of wheat seed, and 14 arrobas of maize seed.

Increased farming would certainly have been profitable in the rich lands of the interior, but a number of factors influenced the limited growth of Spanish Florida's agricultural system. One factor was the vigorous support given by the Franciscans to the doctrine of aboriginal land rights (Chatelaine 1941a:231), echoing responsive chords first struck by Las Casas in the Caribbean a hundred and fifty years before. The crown was officially opposed to private ownership of land in Florida for the same reason--to give an encomienda system no chance to develop--and underscored the primary function of St. Augustine as a presidio charged with the defense of Spain's commercial and territorial interests, not as a food producer and exporter. Nevertheless, abuses did occur as witnessed by the earlier discussion of the 1656 Timucua rebellion.

The few decades prior [illegible] the most productive St. Augustine was to have in terms of the [illegible] economy. In November, 1702, a force of several hundred English and aborigines led by Colonel James Moore of South Carolina moved down the coast destroying the northern chain of missions and making a shambles of villages and cattle ranches in eastern Timucua. Moore laid seige to and burned the town of St. Augustine itself, driving the outlying settlers, ranchers, and aborigines virtually under the guns of the castillo for protection, but was forced to return to South Carolina without having actually captured the Spanish fort (Arnade 1959a). Moore returned in the winter of 1703-1704 with 50 English soldiers and 1300 Creek and other Indian allies to raid the Apalachee area, burning nearly all of the towns and missions and killing or capturing as slaves the majority of the populations. In these two campaigns Moore had destroyed the widespread mission system and the far-flung ranches and farms which had supplied St. Augustine with cattle and corn. For the remainder of the 1st Spanish period the colony's agricultural and livestock activities were effectively restricted to areas within sight of the fort. After Moore's raids the need for supplies from the mitumba increased, and when it did not arrive, many residents of St. Augustine were reduced to eating cats, dogs, rats, and horses (Tepaske 1964:83). Hostilities between England and Spain stemming from the War of Jenkin's Ear in 1739 lasted until 1748, with major threats to St. Augustine coming from Oglethorpe's seiges of the city in 1740 and 1743.

The missions were never started up again as the area was depopulated, and marauding bands of Creeks made work in the interior hazardous. In 1743 Don Francisco Menéndez Marqués died, leaving a will in which he

[illegible] for possessiss, of the La Chua cattle ranch, lost in "the invasion of the enemy and Indian uprising" (Arana 1968). A brief Spanish alliance with the Lower Creek tribes in 1748 allowed St. Augustinians to trade for Indian cattle and to venture outside the fort's protection to cut wood, fish, and farm (Tepaske 1964: 221), but sporadic raids inspired by French and Indian War politics a few years later brought the Spanish and remaining aborigines back to the security of St. Augustine proper. Further evidence of the effect which the missions had on aboriginal settlement and subsistence patterns is shown by the breakdown of the sedentary lifestyle and a return to a pattern of seasonal migration by the remnant Timucua groups following the collapse of the missions and relocation of aboriginal populations in the vicinity of St. Augustine (Doctrineros Census 1725, Geiger 1940).

Juan Solana, in a report to the Bishop of Cuba on the condition of St. Augustine in 1760, frequently mentions the restriction of the populace to the immediate area of the town: "there are no country farms [because] of the continued Indian affronts influenced by the British ..." (Solana 1760: 25) and that men away from the fort "occupied in cutting grass for the oxen" were in danger of attack by the Creeks (ibid., p. 6). He also mentions that since March of 1759 all cultivated lands of many citizens, Negroes and Indians have been abandoned, and hopes that the ". . . Englishman who provides the butcher shop with bovine cattle . . ." will not fail (ibid., p. 7). Fort Mosa, the outer line of St. Augustine's defense perimeter, was intended to be an agricultural "colony" supplying the Spanish with corn and vegetables, yet the fugitive slaves from English settlements and free blacks which made up the population of Fort Mosa were, like

[illegible] Augustine [illegible] Florida South, unable to grow more than enough to support their own people and were always dependent to some degree on incoming supplies (Tepaske 1975:9-10).

It is rather ironic that better support came for St. Augustine in this difficult period from illicit trade with English mercantile trade from the situado itself. In fact by the mid-18th century, St. Augustine could be said to be tied economically to the English colonies (Harman 1969:81), particularly Charleston. Cargo manifests from the period 1716-1763 show Charleston merchants trading pork, beef, salt, flour, herring, cheese, butter, rum, brandy, corn, peas, tallow, and bear to St. Augustine, receiving in return money, oranges, fish, sugar, cocoa, and deerskins. Sea turtles, lumber, and oranges were traded to New York (ibid., Appendix I, II).

This trade continued into the period of actual declared war between England and Spain, although it was of course much less frequent. Commerce was not restricted to ships, for there are records of cattle drives to St. Augustine from Charleston and Savannah. A Charleston merchant arrived with 400 head in June, 1757, and 300 head arrived from Savannah in July of 1760. One Samuel Piles of Savannah was reprimanded after the declaration of war in 1762 for trading 170 bushels of corn and peas and 100 shoats to the Spanish to St. Augustine (ibid., p. 57-61).

By this time the population of St. Augustine had reached 3,000, and the garrison in particular had been increasing since the time of the first seige by Oglethorpe in 1740, reaching a maximum of 2,000 soldiers (well past the normal complement of 300) in 1742 (Chatelaine 1941:87). Even rather substantial trade with the English colonies, combined with

the clus[illegible]situado and the low local yield of produce and cattle was insufficient for the needs of the larger population, and the Spaniards were forced to turn to privateering in order to survive (Harman 1969 63). Conditions were especially desperate by 1762 and the documents indicate the residents subsisted principally on fish and oysters

John Bartram (1942 55) visited St Augustine in 1764, the year after the Treaty of Paris was signed ceding Florida to the British, and reflected on the last years of the Spanish there

> "They [illegible]ate very little flesh meat, but lived chiefly on fish and oysters which they boilde and made much soup, putting great quantities of herbs, onions, and garlic amongst it. If they could get a little salt beef or pork - or, ye better sort, a little fresh - they would cut it in small bits and stew it with pumpkins and herbs or roots with much red pepper which groweth winter and summer here about ye streets, to make what soup they could They kept very few cows, so had no milk [illegible]"

Further hint of increasing pressure on the productive estuarine environment of St Augustine is given by Bartram (ibid.), who notes that fishermen were hard-pressed to obtain enough fish to meet the demand, whereas they used to supply the whole town in plenty! He goes on to say that "[illegible]. oyster shells is now got near so big as these shells that was thrown on heaps by ye Spaniards or Indians [illegible]" Unfortunately we cannot document the increased oyster use archeologically since oyster shells were prime building material in St. Augustine, being burned for lime and included whole in lime and sand mortar in tabby construction. Tabby, wood, and coquina, a naturally-occurring sedimentary shell hash-mixed on nearby Anastasia Island, were the principal building materials. De Brahm, official British surveyor for the American colonies, started his work in

[illegible] East Florida in [illegible] St Augustine, noting that "[illegible] Gardens and Environs of [illegible] Town is chiefly sandy and marshy [illegible] Inhabitants seem to have had a Notion of manuring their Land with Shells, for the rich Soil is near one ninth part shells, one foot deep" (De Vorsey 1971 205).

By all indications, St Augustine, at the close of the 1st Spanish period in 1763, was in serious trouble regarding its food supply. Beef and pork were scarce, although these animals were occasionally driven or shipped into the town illicitly from coastal southeastern British colonies, or legally, and much more rarely, from Havana. At the end, Havana itself had been taken, ceasing any supplies from that port, which was eventually ransomed by ceding Florida to the British. Long gone were the extensive cattle ranches, wheat and corn farms, and friendly Apalachees or Timucuas with whom the Spanish could trade for food. Agricultural products were restricted to home garden plots, arbors, orchards, and cultivated fields within sight of the castillo itself. By the same logic of the containment policy which restricted agricultural production, hunting and collecting in the interior must have suffered as well, restricting the colonists to available salt marsh and barrier island flora and fauna. Finally, historical evidence suggests that resources of the sea were more important than they had been since the early decades of the colony, their availability often meaning the difference between continued existence and starvation.

Some mention should be made of the effects of the situado on St Augustine. Matter (1972 143) has pointed out that "[illegible]. despite complaints by governors and others indicating practically total dependence

situado, such a situation could not have been the case ' remembered that virtually all of the documents detailing the dire effects on the populace when the situado was delayed are letters from local government officials to the king, requesting aid and supplies, and thus having a vested interest When Governor Nicolas Ponce de Leon and the others wrote the crown that "We now depend on that brought in by ship, endangered by shipwreck and robbery by our enemies, by which we lose a great deal Therefore when the supply does not come, many perish of hunger and others go in desperation to hunt the beasts of the woods . ." (See Appendix), they were requesting aid to buy the farm for the crown from one of the signees When Dickinson (1945 83) and his party arrived in 1696 St. Augustine had been without the situado for three years, yet they breakfasted on chocolate with the governor. Perhaps a fruitful avenue of research would be a correlation of deaths listed in the Parish Records to the years of the situado's absence.

The Archeological Evidence

Recent archeological research in St. Augustine in late 1st Spanish period contexts presented an opportunity to get hard evidence on the nature of the city's food supply during a time of crisis. The particular sites chosen, roughly contemporaneous houses inhabited by mestizo, criollo, and Spanish families, afforded in addition a unique opportunity to sample the foodways of these different ethnic/social groups operating within the same environment. Relatively precise information is available on the inhabitants from the Parish Records of the Cathedral of St. Augustine (St Augustine Historical Society n.d.) which lists births, deaths, and marriages Property ownership at the time of the British takeover is noted in the Puente map of 1764

The Maria de la Cruz house (SA16-23) was excavated during field sessions in 1972 and 1973 by crews under the direction of Charles H Fairbanks and Kathleen A. Deagan, respectively. This was a mestizo household, occupied by an Indian woman (probably Guale) named Maria de la Cruz, her soldier husband, Joseph Gallardos from New Spain, and their three children. Documentary and archeological evidence suggests a midpoint of occupation of about 1748 (Deagan 1974-Appendix I), although the house still belonged to the heirs of Maria de la Cruz in 1763

Excavations at the Arosta house site (SA13-5) by Deagan in 1974 revealed an earlier occupation which she was able to trace to one Gertrudis de la Pasqua (Deagan 1974, personal communication), a criollo, or person of Spanish descent born in the New World. Her husband and father were both officers with the presidio force It is probable that this house was occupied by the de la Pasqua family until 1763.

The third site, and the one which eventually yielded the largest home sample, was the Ximenez-Fatio house site (SA34-2), excavated in 1973-1974 by John W Clauser, Jr. The major occupation at this site prior to the 2nd Spanish period was that of Christoval Contreras, who is listed as the owner of the lot and two structures in the 1764 Fuente map (Ximenez-Fatio House Study Committee 1973) A search of the parish records indicates that Contreras, a native of Tenerife in the Canary Islands, was married to Dorotea de Arayn, a native of St. Augustine They married sometime before 1758 and had at least two children, the last born in the crisis month of January, 1763 The records also indicate that Contreras had at least one female slave (St Augustine Historical Society n d)

Each of the sites will be discussed briefly in terms of its own particular contribution to our knowledge of Spanish colonial foodways. The more similar aspects such as butchering data, fishing, hunting, and animal husbandry techniques will be compared and contrasted in arriving at a larger view of St. Augustine as part of the New World Spanish colonial dietary tradition.

Maria de la Cruz House

The 41 species recovered at this meatier household represent the widest range of habitats exploited of the St. Augustine sites under study. However, of the wild species represented, many inhabit the salt marsh, tidal creek, or adjacent life zones (see Figure 9) to which the colonists must have been restricted in the mid-18th century.

A summary of a number of variations on the classic species list is presented in Table 5. The tabular headings, MNI, number of fragments, bone weight, percent MNI, percent fragments, and percent bone weight, need no further explanation. The next two headings are edible meat weight (White 1955) and percent edible meat, based on the MNI per species. The last two headings reflect essentially the same measure, edible meat, but in this case the edible meat figure is derived from the ratio of edible meat weight to bone weight in a particular species (Reed 1963, Ziegler 1973). These edible meat figures are generally considerably lower than those obtained by multiplying the MNI times a set weight per individual, although the percentage contribution is essentially the same. The difference between the two methods is best explained by an example: the recovery of one femur of an adult domestic pig, Sus scrofa, would represent one individual and therefore, perhaps 72 pounds edible weight by the MNI

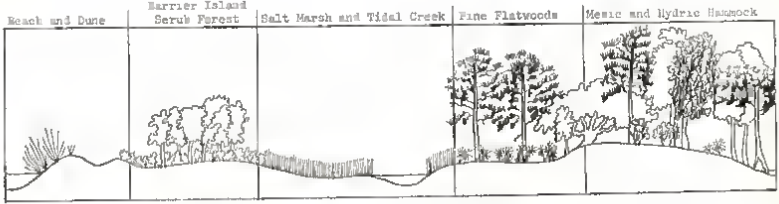


FIGURE 9 Idealized East-West Transect of Life Zones from the Coast Inland, St. Augustine, Florida
Not to scale

Table 5 Measures of Relative Abundance of Vertebrate Fauna at Maria de la Cruz House, SA 16-23.

Species	MNI	Fragment	Bone Weight (gm)	Percent MNI
MAMMALS				
Scalopus aquaticus Eastern mole	1	4	1.0	.99
Sciurus carolinensis Eastern gray squirrel	1	1	.5	.99
Mus musculus House mouse	1	2	.5	.99
Rattus rattus Black rat	1	3	.5	.99
Urocyon cinereoargeateus Grey fox	1	1	1.0	.99
Procyon lotor Raccoon	1	2	3 0	.99
Felis catus Domestic cat	1	2	1.5	.99
Sus scrofa Domestic pig	3	27	142.0	2.97
Odocoileus virginianus White-tailed deer	1	9	11.0	.99
Bos taurus Domestic cow	3	66	978.5	2.97
Unidentified mammal		1275	970.0	
TOTAL MAMMALS	14	1392	2109.5	13 86

Table 5 - Extended

Percent Fragment	Percent Bone Weight	MNI		Bone Weight	
		Edible Meat Weight (gm)	Percent Edible Meat	Edible Meat Weight (gm)	Percent Edible Meat
.08	.03	70.0	.01	15.5	.04
.02	.02	592.0	.09	7.1	.02
.04	.02	30.0	.004	7.8	.02
.06	.02	140.0	.02	7.8	.02
.02	.03	1697.5	.25	8.0	.02
.04	.10	2947.0	.43	37.8	.10
.04	.05	2270.0	.33	14.6	.04
.55	4.96	120764.0	17.59	1420.0	3.78
.18	.38	31780.0	4.63	150.7	.40
1.34	34.17	374550.0	54.55	15068.9	40.13
25.81	33.87			12610.0	33.58
28.18	73.65	534840.5	77.80	29348.2	78.15

Table 5 - Continued

Species	MNI	Fragment	Bone Weight (gm)	Percent MNI
BIRDS				
Anas discors Blue-winged teal	1	4	.5	.99
Lophodytes cucullatus Hooded merganser	1	1	.5	.99
Gallus gallus Domestic chicken	2	6	6.5	1.98
Meleagris gallopavo Domestic (?) turkey	1	2	11.0	.99
Burhinus bistriatus Mexican thick-knee	1	1	1.0	.99
Numenius americanus Long-billed curlew	1	1	.5	.99
Limnodromus griseus Short-billed dowitcher	1	1	.5	.99
Capella gallinago Common snipe	1	1	.5	.99
Unidentified bird		25	9.5	
TOTAL BIRDS	9	39	30.5	8.91
AMPHIBIANS AND REPTILES				
Bufo cf. B. terrestris Southern toad	2	10	1.5	1.98
Rana sp. Frog	1	1	.5	.99

Table 5 - Extended

Percent Fragment	Percent Bone Weight	MNI		Bone Weight	
		Edible Meat Weight (gm)	Percent Edible Meat	Edible Meat Weight (gm)	Percent Edible Meat
.02	.02	515.0	.08	7.2	.02
.02	.02	515.0	.08	7.2	.02
.12	.23	1562.0	.23	101.4	27
.04	.38	4767.0	.69	171.6	.46
.02	.03	350.0	05	17.6	.05
.02	.02	350.0	.05	8.8	02
.02	.02	97.0	.01	8.8	.02
02	.02	97.0	.01	8.8	.02
.51	.33			148.2	.39
.79	1.07	8253.0	1.20	479.6	1.27
.20	.05	48.0	.01	18.0	.05
.02	.02	10.0	.001	6.0	.02

Table 5 - Continued

Species	MNI	Fragment	Bone Weight (gm)	Percent MNI
Chelydra serpentina Snapping turtle	1	1	.5	.99
Malaclemys terrapin Diamondback terrapin	2	8	6.0	1.98
Gopherus polyphemus Gopher tortoise	1	2	6.5	.99
Chelonia mydas Green turtle	1	47	252.0	.99
Unidentified turtle		11	3.5	
Masticophis flagellum Coachwhip	1	1	.5	.99
TOTAL AMPHIBIANS AND REPTILES	9	81	271.0	8.91
FISH				
Galeocerdo cuvieri Tiger shark	1	1	.5	.99
Carcharhinidae Requiem shark	1	2	1.0	.99
Sphyrna cf. S. tiburo Bonnethead	1	1	.5	.99
Pristis sp. Sawfish	1	1	.5	.99
Ariue felis Sea catfish	22	136	49.0	21.78
Bagre marinus Gaffstopsail catfish	5	30	11.0	4.95

Table 5 - Extended

Percent Fragment	Percent Bone Weight	MNT Edible Meat Weight (gm)	MNT Percent Edible Meat	Bone Weight Edible Meat Weight (gm)	Bone Weight Percent Edible Meat
.02	.02	2387.0	35	1.8	01
16	.21	1574.4	.23	11.4	.03
04	.23	1906.8	.28	22.8	.06
.95	8.80	45400.0	6 61	441.0	1.17
22	12			10.5	.03
02	.02	749.1	11	3.0	.01
1.63	9.47	52075.3	7.59	514.5	1.38
02	.02	4086.0	.60	10.0	03
04	03	8172.0	1 19	20.0	.05
.02	.02	5448.0	.79	10.0	.03
.02	02	2724.0	40	10.0	.03
2.75	1.71	11237.6	1.64	754.6	2.01
.61	.38	2554.0	37	169.4	.45

Table 5 - Continued

Species	MNI	Fragment	Bone Weight (gm)	Percent MNI
Ariidae Sea catfish		124	25.5	
Pomatomus saltatrix Bluefish	1	1	.5	.99
Archosargus probatocephalus Sheepshead	6	43	35.0	5.94
Cynoscion nebulosus Spotted seatrout	1	1	1.0	.99
Cynoscion sp. Seatrout	1	3	1.5	.99
Menticirrhus cf. M. americanus Southern kingfish	2	11	1.5	1.98
Pogonias cromis Black drum	2	13	6.0	1.98
Sciaenops ocellata Channel bass, red drum	3	16	36.5	2.97
Mugil sp. Mullet	17	95	12.0	16.83
Paralichthys sp Flounder	2	12	1.5	1.98
Opsanus tau Oyster toadfish	3	7	2.0	2.97
Unidentified fish		2931	267.5	
TOTAL FISH	69	3428	453.0	68.31
SITE TOTALS	101	4940	2864.0	99.99

Table 5 - Extended

		MNI		Bone Weight	
Percent Fragment	Percent Bone Weight	Edible Meat Weight (gm)	Percent Edible Meat	Edible Meat Weight (gm)	Percent Edible Meat
2.51	.89			392.7	1.05
.02	.02	544.8	.08	8.0	.02
.87	1.22	8716.8	1.27	560.0	1.49
.02	.03	1089.6	.16	16.0	.04
.06	.05	544.8	.08	24.0	.06
22	.05	1089.6	.16	24.0	.06
.26	21	19976.0	2.91	96.0	.26
.32	1.27	13801 6	2.01	584.0	1.56
1.92	42	9261.6	1 35	192.0	.51
.24	.05	1089.6	16	24.0	.06
.14	.07	1089.6	.16	32.0	.09
59 33	9 34			4280 0	11 40
69.37	15 89	91425 6	13.33	7206-7	19.20
99.97	99 99	686594 4	99 92	37549.0	100 00

method while the [illegible] fair, based on bone weight-edible meat weight ratios, would indicate a weight closer to that derived from one ham Neither one of the edible weight figures is completely satisfactory, although the higher value (MNI) must certainly come closer to an actual representation of meat consumed by a family over a period of several years The values derived from bone fragment weight have the one advantage of accounting for the weight contribution of "unidentified" mammal, fish, and other remains not ascribed to particular species Raw data on edible meat weight are from White (1953), Ziegler (1973), and files in the Florida State Museum Zooarchaeology Laboratory

The mass of figures in Tables 5, 6, and 7 is not meant to be overwhelming but is presented for two reasons one, to learn more of the specific nature of faunal use at each site, and two, that through side-by-side presentation of various standard methods of data analysis, some idea of the similarities and differences in results can be achieved It is toward these ends that Table 8 has been constructed as a summary of percentage contribution

The diversity of the life zones exploited is the most striking thing about the de la Cruz site, although the wild vertebrate mammals taken from these life zones do not contribute more than 27 percent of identified species to the edible meat in the diet From reading the documents, however, the timing of the contribution, and not its overall dietary significance, may be the important factor

Invertebrate species recovered from the site include blue crab (Callinectes sapidus), stone crab (Menippes mercenaria), lightning whelk (Busycon contrarium), stout tagelus (Tagelus plebius), northern quahog

(Mercenaria mercenaria), and most importantly, the eastern oyster (Ostrea virginica). All are shallow water, brackish, tidal species. The whelk, quahog, and tagelus specimens would have been individually hand collected, and the crabs were probably hand-net collected near shore and on shoal and sand bar areas in the bay if not in traps or pots. Oysters are represented by a significant percentage of small individuals which may indicate overharvesting. What may be a fairly intensive use of shellfish here is clearly an aboriginal trait and would refute the implications of transfer of Old World subsistence practices and underscores the importance of acculturative factors in the food supply.

The presence of individuals of numerous seasonal wild bird species indicates a lot of time spent hunting or trapping in the marsh during the winter months. Most of the other wild species from the de la Cruz site can be taken in the tidal creeks, salt marshes, and adjacent forest fringe areas, although the squirrel, deer, hooded merganser, snapping turtle, gopher tortoise, and coachwhip were probably taken farther inland. The green turtle is too small an individual to have been caught on a nesting beach and was most likely netted or hooked on its feeding grounds. The wide range of wild species and the variety of habitats represented is not characteristic of Old World Spanish models. The similarity to aboriginal procurement systems supports the importance here of acculturative processes.

The shark and sawfish remains were of relatively small individuals, possibly netted but probably caught with hook and line or speared in inshore waters. The bony fishes represented are inshore, shallow water marine species common in the inland waterway and tidal creeks around seawalls, docks, pilings, and oyster beds. They were probably caught with hook and line. The exception is mullet, probably caught in the

same inshore waters but by net rather than hook and line. Four lead weights were recovered from the site. These may be net weights and would indicate net fishing by members of the household (Deagan 1974:106). Drums and sharks were the most important species in terms of edible meat. Again, this usage of fish resources is not characteristic of Spanish models of commercial fishery. It does have similarities to Spanish subsistence fishing techniques but more closely resembles aboriginal models, again supporting the importance of acculturative factors.

The most interesting species recorded at any of the St. Augustine sites under study in terms of uniqueness and cultural implications is the Mexican Thick-Knee (Burhinus bistriatus). The natural occurrence of this bird has never been noted in this country by ornithologists, suggesting the need for an explanation other than natural range extension. The range of the bird is in South and Central America, Southern Mexico, and Hispaniola, where it was probably a Spanish introduction. There was no logical reason for a single individual of this or any other species to have been imported such a distance for food, the more plausible explanation is in a documentary reference describing the Mexican Thick-Knee as "[illegible] typically shy, but if caught young and kept as a domestic pet it becomes utterly fearless, to function as a noisy 'watch dog' at night [illegible]" (Thomson 1964:816). Apparently in some parts of Latin America even within recent years this bird's raucous call and nocturnal habits made it a perfect watchbird. The femur of the bird, recovered in good 1st Spanish period context at the de la Cruz site, is pictured in Figure 10. Presence

Figure 10 Left femur of Mexican Thick-Knee, Burhinus bistriatus, from refuse pit associated with Maria de la Cruz house, SA 16-23, St. Augustine, Florida.

of the Mexican Thick-Knee, along with other items of material culture recovered from the site, indicate that the mestizo household was not on the fringe of St. Augustine society.

Domestic mammals were the mainstay of the meat portion of the diet at the de la Cruz house, supporting one of the major implications of the transfer to the New World of subsistence practices stressing the importance of European domestic animals. However, cow and pig are the most important animals; sheep and goat are not present. Other domestic or introduced mammals not generally thought of as food, but present in pits and midden debris included the domestic cat, the house mouse, and the black rat. The bones exhibited no butchering scars, but occurred as individual elements with remains of other species in closed pits, and the animals they represent are thus considered as food items.

Floral remains identified from the site include charred maize cobs, peach pits, an orange, wild cherry (Prunus serotina), seeds of two species of watermelon (Citrullus lanatus and C. vulgaris), and a pumpkin (Cucurbita pepo) (Deagan 1974:84-85). The peach, orange, and watermelons are European introductions, and demonstrate an acculturative blend of foodways from two traditions.

Plant food processing tools found in the site include basalt mano fragments, part of one metate, and one mortera, all of Mesoamerican aboriginal origin. A sherd griddle found at the site, of local San Marcos paste, is similar to those of Mexico and the Caribbean and is considered to be a trait introduction. Florida aborigines had correlates to the other items of food production equipment but apparently used the technologically superior Mesoamerican items in St. Augustine colonial situations (Deagan

1974-81-82). The only obvious native aboriginal food processing and preparation equipment present is the ubiquitous San Marcos pottery, apparently used throughout at least the last century of the 1st Spanish period occupation as the dominant cooking vessel in St. Augustine (Otto and Lewis 1974). The presence of aboriginal food processing equipment and the virtual exclusion of similar items of Spanish technology at the Maria de la Cruz site seems to support Deagan's (1973) hypothesis of female aboriginal influence at mestizo sites where the male element was Spanish.

Gertrudis de la Fragua House

For many reasons the data from this criollo household are interesting. Once again the male of the household was a part of the military garrison and not directly or at least primarily involved in food production, procurement, or preparation. However, this time the female was native-born of Spanish descent, and presumably not as intimately acquainted with local resources as an Indian woman. Nevertheless, criollos were known for their familiarity with the local environment and its resources, and it was felt by officers of the castillo that " ... in lean times they (criollos) would not have the usual flour ration, which could then be used exclusively for those who had come from abroad" (Arana 1960 88).

There was at times active discrimination against criollo soldiers in the make-up of the garrison, the ratio of criollos to peninsulares in the garrison being of great concern to Spanish officials (ibid., p. 81-90). Criollos were simply not trusted by the officials, who reasoned that the first loyalty of the criollos would be to the land of their birth, never having known Spain and its institutions (Zavala 1943 78).

[illegible] were more limited in time and scope than those of the de la Cruz site, and consequently the sample from closed contexts was smaller. Nevertheless, remains of 50 individual vertebrates were recovered, representing 25 species. A listing and tabulation of the data are presented in Table 6.

The proportion of domestic to wild vertebrates in the diet remained about 3:1 as at the de la Cruz site, with the most important animals again being cow and pig. Although the variety of species and the number of individuals is less than that of the de la Cruz site, the percentage representation by class is very similar. Life zone exploitation was generally similar, but there is perhaps less reliance on the salt marsh and in particular its avifauna.

Again some species of reptiles and mammals represent collecting and hunting in inland areas removed from the town. There also continue to be non-traditional food species present in closed context pits, such as the house mouse, black rat, and domestic dog. These are again considered as food species since single elements were found as opposed to complete or largely complete skeletons. With the exception of wild bird trapping or hunting, the basic food procurement system is very similar to the de la Cruz household. The one other noticeable difference is in the faunal composition of individual pits, where there were often alternate concentrations of either fish or mammal remains.

Christoval Contreras House

Although Solano (1750) informs us that the Canary Islanders originally brought over to populate the presidio and cultivate the land were at that time in "the most wretched conditions," evidence from the Contreras

Table 6. Measures of Relative Abundance of Vertebrate Fauna at Acosta Site, SA 13-5, Gertrudis de la Pasqua Occupation.

Species	MNI	Fragment	Bone Weight (gm)	Percent MNI
MAMMALS				
Mus musculus House mouse	1	2	.5	2.00
Rattus rattus Black rat	2	5	1.0	4.00
Canis familiaris Domestic dog	1	1	.5	2.00
Procyon lotor Raccoon	1	5	2.0	2.00
Sus scrofa Domestic pig	2	10	43.0	4.00
Odocoileus virginianus White-tailed deer	1	2	13.0	2.00
Bos taurus Domestic cow	2	99	1225.0	4.00
Unidentified mammal		942	579.5	
TOTAL MAMMALS	10	1066	1864.5	20.00
BIRDS				
Gallus gallus Domestic chicken	2	7	3.0	4.00
Passerine Songbird	1	1	.5	2.00
Unidentified bird		22	4.5	
TOTAL BIRDS	3	30	8.0	6.00

Table 6 - Extended

Percent Fragment	Percent Bone Weight	MNI		Bone Weight	
		Edible Meat Weight (gm)	Percent Edible Meat	Edible Meat Weight (gm)	Percent Edible Meat
.08	.03	30 0	.006	7.8	.027
.19	.05	140.0	03	15.5	.055
.04	.03	5975.0	1.269	7.8	.027
.13	10	2947.0	.626	25.2	.089
.33	2 20	95340 0	20.25	430-0	1.515
.08	.66	31780.0	6.75	178.1	.627
3.89	62 60	249700 0	53 036	18865.0	66 453
37.00	29.61			7533.5	26 537
41 86	95 28	385918 0	81 967	27062 9	95 330
.27	15	1562.0	332	46.8	165
04	.03	16 0	.003	10.0	035
86	23			70.2	.247
1 17	41	1588 0	.335	127 0	447

Table 6 - Continued

Species	MNI	Fragment	None Weight (gm)	Percent MNI
AMPHIBIANS AND REPTILES				
Bufo sp Toad	1	1	.5	2.00
Osirochelys reticularis Chicken turtle	1	1	.5	2.00
Malaclemys terrapin Diamondback terrapin	1	3	2.5	2.00
Gopherus polyphemus Gopher tortoise	2	7	7.0	4.00
Unidentified turtle		8	2.0	
Alligator mississipiensis Alligator	1	3	6.5	2.00
TOTAL AMPHIBIANS AND REPTILES	6	23	19.0	12.00
FISH				
Galeocerdo cuvieri Tiger shark	1	1	.5	2.00
Carcharhinidae Requiem shark	1	2	1.0	2.00
Arius felis Sea catfish	2	15	3.5	4.00
Archosargus probatocephalus Sheepshead	2	2	1.0	4.00
Cynoscion regalis Weakfish	1	1	.5	2.00

Table 6 - Extended

Percent Fragment	Percent Bone Weight	MNI		Bone Weight	
		Edible Meat Weight (gm)	Percent Edible Meat	Edible Meat Weight (gm)	Percent Edible Meat
.04	.03	24.0	.005	6.0	.021
.04	.03	1032.9	.219	1.4	.005
.12	.13	787.2	.167	4.8	.017
.27	.36	3813.6	.81	24.5	.086
.31	.10			6.0	.021
.12	.33	34050.0	7.232	104.0	.366
.90	1.11	39707.7	8.433	146.7	.516
.04	.03	20430.0	4.339	10.0	.035
.08	.05	8172.0	1.736	20.0	.07
.59	.18	1021.6	.217	53.9	.19
.08	.05	908.0	.193	16.0	.056
.04	.03	544.8	.116	8.0	.028

Table 6 - Continued

Species	MNI	Fragment	Bone Weight (gm)	Percent MNI
Cynoscion sp. Seatrout	1	1	.5	2.00
Menticirrhus americanus Southern kingfish	5	40	1.5	10.00
Menticirrhus sp. Whiting	1	1	.5	2.00
Micropogon undulatus Croaker	2	2	.5	4.00
Mugil sp Mullet	14	230	12.0	28.00
Paralichthys sp. Flounder	1	2	1.0	2.00
Unidentified fish		1130	43.0	
TOTAL FISH	31	1427	65.5	67.00
SITE TOTALS	50	2546	1957.0	100.00

Table 6 - Extended

Percent Fragment	Percent Bone Weight	Edible Meat Weight (gm)	Percent Edible Meat	Bone Weight: Edible Meat Weight (gm)	Bone Weight: Percent Edible Meat
.04	.03	544.8	.116	8.0	.028
1.57	.08	2724.0	.579	24.0	.085
.04	.03	544.8	.116	8.0	.028
.08	.03	544.8	.116	8.0	.028
9.03	.61	7627.2	1.62	192.0	.676
.08	.05	544.8	.116	16.0	.056
44.38	2.20			688.0	2.424
56.05	3.37	43606.8	9.264	1051.0	3.704
99.98	100.17	470814.5	99.999	28388.5	99.859

occupation indicates that there were some emigrants who did well for themselves even in such a time of crisis. Contreras' occupation is unknown, but the fact that he owned at least one slave and could afford some of the finer more expensive items of material culture (John W. Clauser, Jr., 1975, personal communication) set him somewhat apart in a material sense from the de la Cruz and de la Pasqua households, although as Deagan (1974) points out, even the mestizo household could not be considered impoverished.

It is obvious from the data presented in Table 7 that the faunal sample is much larger for the Contreras household. Particularly noticeable are the number and variety of domesticants. The domestic fauna from the Contreras occupation resemble much more closely the picture presented by Manucy (1962:127) of St. Augustine's houses with specialized outbuildings for various animals, including chicken houses and yards, pigeon lofts (for a winter food supply), stables, and hog houses. Included in the fauna from the site were bones of numerous chickens, a few turkeys, a domestic goose, and a domestic pigeon, in addition to several cows and pigs, one sheep, and a lamb. These domestic fauna from the Contreras house resemble much more closely the Old World model of livestock use, although there are fewer sheep and no goats present.

In spite of the number and variety of domesticants, however, the percent dietary dependence on domestic animal sources decreased seven to ten percent from the other two households to 67 percent. This decrease reflects an increase in the size, and consequently the dietary contribution, of fish, in addition to a significantly higher proportion of deer remains present in the site. Many fishes, particularly drums in

Table 7 Measures of Relative Abundance of Vertebrate Fauna at Ximenez-Fatio House, SA 34-2, Christoval Contreras Occupation

Species	MNI	Fragment	Bone Weight (gm)	Percent MNI
MAMMALS				
Didelphis marsupialis Opossum	1	2	4.5	.65
Sylvilagus sp. Rabbit	2	10	10.5	1.30
Rattus rattus Black rat	1	1	.5	.65
Ursus americanus Black bear	1	1	60.5	.65
Procyon lotor Raccoon	1	8	13.0	.65
Felis catus Domestic cat	1	9	28.5	.65
Sus scrofa Domestic pig	7	227	1720.5	4.55
Odocoileus virginianus White-tailed deer	6	126	1283.0	3.90
Bos taurus Domestic cow	7	251	8128.5	4.55
Ovis aries Domestic sheep	2	3	15.5	1.30
Unidentified mammal		2131	5808.5	
TOTAL MAMMALS	29	2769	17073.5	18.85
BIRDS				
Morus bassanus Gannet	1	1	3.5	.65

Table 7 - Extended

Percent Fragment	Percent Bone Weight	MNI Edible Meat Weight (gm)	MNI Percent Edible Meat	Bone Weight Edible Meat Weight (gm)	Bone Weight Percent Edible Meat
.05	.02	2345.0	.12	54.9	.02
.23	.05	2179.2	.12	121.8	.05
.02	003	140.0	01	7 8	.003
.02	.31	143010.0	7.58	943.8	.36
.18	07	2947.0	.16	163.8	.06
.20	.14	2270.0	12	276.5	.11
5.11	8 72	333690 0	17.70	17205.0	6 63
2.84	6.50	190680 0	10 11	17577.1	6.78
5.65	41 20	873950 0	46.35	125178.9	48.26
.07	.08	31780.0	1.69	212.4	.08
47.96	29 44			75510.5	29 11
62 33	86.53	1582991.2	83.96	237252.5	91 46
.02	.02	2542.0	.13	49.0	02

Table 7 - Continued

Species	MNI	Fragment	Bone Weight (gm)	Percent MNI
Cathartes aura Turkey vulture	1	1	3.0	.65
Anser anser Domestic goose	1	1	4.0	.65
Gallus gallus Domestic chicken	10	131	141.5	6.49
Meleagris gallopavo Domestic (?) turkey	2	2	18.0	1.30
Catoptrophorous semipalmatus Willet	1	1	.5	.65
Columba livia Domestic pigeon	1	1	.5	.65
Unidentified bird		4	4.0	
TOTAL BIRDS	17	142	175.0	11.04
AMPHIBIANS AND REPTILES				
Chrysemys scripta Yellow-bellied turtle	1	1	18.0	.65
Deirochelys reticularis Chicken turtle	1	1	1.0	65
Malaclemys terrapin Diamondback terrapin	2	5	9.0	1.30
Terrapene carolina Box turtle	1	1	.5	.65
Gopherus polyphemus Gopher tortoise	14	538	1529.0	9.09
Caretta caretta Atlantic loggerhead	1	6	9.5	65

Table 7 - Extended

Percent Fragment	Percent Bone Weight	MNI Edible Meat Weight (gm)	MNI Percent Edible Meat	Bone Weight Edible Meat Weight (gm)	Bone Weight Percent Edible Meat
02	.02	2542.0	.13	42.0	.02
.02	.02	2450.0	13	61.6	.02
2.55	72	7810.0	.41	2207.4	.85
.05	.09	8399.0	.45	280.8	.12
.02	003	97.0	01	8.8	.003
.02	.003	178.0	.01	8.1	.003
09	02			62.4	.02
3.19	90	24018.0	1.27	2718.1	1.06
.02	09	1925.0	.10	32.4	.01
.02	.01	1032.9	.05	2.7	.001
.11	.05	1574.4	.08	17.1	.01
.02	.003	442.7	.02	1.4	.001
12.12	7.75	26695.2	1.42	5351.5	2.06
14	05	4540.0	.24	17.1	.01

Table 7 - Continued

Species	MNI	Fragment	Bone Weight (gm)	Percent MNI
Cheloniidae Sea turtle	2	30	49.5	1.30
Unidentified turtle		1	.5	
Alligator mississippiensis Alligator	1	2	27.0	.65
TOTAL AMPHIBIANS AND REPTILES	23	586	1644.0	14.94
FISH				
Galeocerdo cuvieri Tiger shark	1	5	7.5	.65
Carcharhinidae Requiem shark	2	18	14.0	1.30
Sphyrna tiburo Bonnethead	1	13	9.5	.65
Sphyrnidae Hammerhead	1	4	2.5	.65
Arius felis Sea catfish	13	82	71.5	8.44
Bagre marinus Gafftopsail catfish	1	2	4.5	.65
Archosargus probatocephalus Sheepshead	2	8	10.0	1.30
Cynoscion sp. Seatrout	2	8	3.5	1.30
Menticirrhus sp. Whiting	1	1	5	.65

Table 7 - Extended

Percent Fragment	Percent Bone Weight	MNI Edible Meat Weight (gm)	MNI Percent Edible Meat	Bone Weight Edible Meat Weight (gm)	Bone Weight Percent Edible Meat
.68	25	7945.0	.42	89.1	.03
.02	.003			1.5	001
.05	.14	34050.0	1.81	432.0	.17
23 18	8.35	78205.2	4.14	5944 8	2 29
.11	.04	10896.0	.58	150.0	.06
.41	.07	31326 0	1 66	280.0	.11
.29	.05	4086 0	.22	190.0	.07
.03	.01	4086.0	.22	50.0	.02
1 85	36	8853.0	.47	1101 1	.42
.05	.02	510.8	.03	69.3	.03
.18	.05	2905 6	.15	150.0	.06
.18	.02	1997 6	.11	56.0	.02
.02	.003	544 8	.03	8.0	.003

Table 7 - Continued

Species	MNI	Fragment	Bone Weight (gm)	Percent MNI
Micropogon undulatus Croaker	1	1	.5	.65
Pogonias cromis Blackdrum	6	36	174.5	3.90
Sciaenops ocellata Channel bass, red drum	10	54	143.0	6.49
Mugil sp. Mullet	42	176	58.5	27.27
Paralichthys sp. Flounder	2	18	8.5	1.30
Unidentified fish		520	329.5	
TOTAL FISH	85	946	838.0	55.20
SITE TOTALS	154	4443	19730.5	100.03

Table 7 - Extended

Percent Fragment	Percent Bone Weight	MNI		Bone Weight	
		Edible Meat Weight (gm)	Percent Edible Meat	Edible Meat Weight (gm)	Percent Edible Meat
.02	.003	1089.6	.06	8.0	.003
.81	.88	46852.8	2.48	2792.0	1.08
1.22	.72	53753.6	2.85	2285.0	.88
3.96	.30	30508.8	1.62	936.0	.36
.41	.04	2905.6	.15	136.0	.05
11.70	1.67			5272.0	2.03
21.30	4.25	200316.2	10.63	13496.4	5.20
100.00	99.85	1885527.6	100.00	259411.8	99.98

[illegible] to five lb [illegible] mostly mullet and drum, and [illegible] consistently represented by 20-40 lb individuals at the Contreras house. There is no reason to believe that either Contreras or his servant(s) were better fishermen than members of the other households, consistently procuring very large fishes. Alternatively they represent the efforts of a full-time, professional market or contract fisherman. A map by Jefferys of the "Plan of the Town and Harbor of St. Agustin" (Roberts 1763-24) shows, at the entrance to the harbor, what looks like a weir stretched between two sand bars and labeled "Fishermen." This is not the optimum habitat for large drum, but it does indicate the presence of fishing specialists. Other than their larger size, the fish species represented in the Contreras refuse are remarkably similar to those found at the other two houses.

In 1598, Gonzalo Méndez de Canzo, Governor, wrote Phillip II that "--- after my arrival I caused a market place to be established, where everybody could come to sell, and houses of fish and meat markets, where there would be weight and measure, which heretofore had been lacking ---." That the market was still in existence in the late 18th century is demonstrated by the engineer and mapmaker Mariano de La Rocque, who in his general report of the city of St Augustine for 1789 describes the building which " --- remains a butcher shop and public market ---." (St. Augustine Historical Society 1964)

The presence of a bear and several deer indicate a hunting contribution to the diet of about 15 percent, far greater than at either the de la Cruz or de la Paeque sites. This concentration might again indicate the presence of a specialist supplying the Contreras household,

either through market or cor[illegible] Lewis Binford (1975 personal communication) has suggested that a study of the deer elements represented might provide data to support this hypothesis. Presence of bones indicating "meaty" cuts such as the rump or round to the exclusion of ribs, shank, feet, and brisket would indicate selection of choicer cuts, whereas the presence of bones representing more of the entire carcass might indicate more total use of the deer by its hunter.

A study of elements represented (Table 11) shows the presence of parts of the entire deer skeleton, although cranial elements, vertebrae, ribs, and distal limbs are not as frequently represented as the meaty portions of the four quarters. This evidence is somewhat inconclusive, but regardless of who hunted the animals, they do represent numerous forays away from the protection of the fort. These hunting and collecting trips are further confirmed by the several terrestrial and freshwater turtle species present in the sample. The presence of numerous gopher tortoises may indicate a precursor to St. Augustine's famed Minorcan gopher stew.

Once again the domestic cat and black rat are present in pits and features of reliable late 1st Spanish period context. Unusual species present include a gannet, a large bird which is an offshore winter visitor (taken from a fishing boat?), and a turkey vulture. Oviedo (1959:66) makes a convincing explanation for its presence.

> .. they have poor flesh and a worse taste, are very gluttonous, and eat much filth, dead Indians and animals. They smell like musk. The odor is very pleasing as long as they are alive, but it is lost as soon as the birds are killed. They are good for nothing except to provide feathers

Table 8. Summary of Percentage Contribution of Vertebrate Fauna by Site, St Augustine

Vertebrate Class	Percent MNI	Percent Fragment	Percent Bone Weight	MNI Percent Edible Meat	Bone Weight Percent Edible Meat
MARIA DE LA CRUZ HOUSE, SA 16-23					
Mammals	13.9	28.2	73 7	77.8	78.2
Birds	8 9	.8	1 1	1.2	1.3
Amphibians and Reptiles	8.9	1 6	9.5	7.6	1.4
Fish	68.3	69 4	15 8	13.3	19.2
Total	100 0	100 0	100 1	99.9	100 1
ACOSTA SITE, SA 13-5, GERTRUDIS DE LA PASQUA OCCUPATION					
Mammals	20 0	41.9	95 3	82 0	95.3
Birds	6 0	1.2	.4	3	4
Amphibians and Reptiles	12.0	9	1 1	8 4	.5
Fish	62.0	56 1	3.4	9.3	3.7
Total	100.0	100 1	100 3	100.0	99 9
XIMENEZ-FATIO HOUSE, SA 34-2, CHRISTOVAL CONTRERAS OCCUPATION					
Mammals	18 9	62 3	86.5	84 0	91.5
Birds	11.0	3.2	.9	1-3	1.1
Amphibians and Reptiles	14.9	13.2	8 4	4 1	2.3
Fish	55 2	21 3	4.3	10.6	5.2
Total	100 0	100 0	100 1	100.0	100.1

for arrows and darts. They can stand a hard blow, and the bait that kills one must have tremendous force or hit its head or break a wing. They are very troublesome, and like to stay in or near the city in order to be able to eat the garbage.

Butchering and Cooking Techniques

Residents of St. Augustine seem to have gotten most of their fresh meat from the city slaughterhouse or from butcher shops in the market. Salted meat, cut into manageable portions and packed in barrels, came into the city from Charleston, Savannah, and Havana. Some local beef and pork was probably salted and stored when there were temporary surpluses. Juan Solana reported in 1760 that " . . . the citizenry maintain themselves most of the year with salted meat, fish which is abundant in the river, and some vegetables. At present some cattle are slaughtered at a house that is inside the enclosure which is for the butcher shop operated by an Englishman of the population."

Butchering technique does not seem to have differed appreciably from house to house. All observed butchering cuts and scars were made with metal tools, almost exclusively with knives and cleavers (see Figure 11), although some of the larger bones may have been cut with an axe. The majority of the bones were simply broken.

Of the hundreds of domestic animal bones present in the sample, less than a half dozen exhibit saw cuts. Stanley South (1975 personal communication), based on his extensive work in British and American sites, is of the opinion that sawn bone does not occur with ceramics of the 18th century prior to the introduction of pearlware ca. 1780. Ivor Noël Hume (1975 personal communication) was unable to supply firm data from

Figure 11. Left proximal radius and ulna of domestic pig, Sus scrofa, from refuse pit associated with Maria de la Cruz house, SA 16-23, St Augustine, Florida. Specimens shows characteristic butchering scars from metal knife and/or cleaver.

Williamsburg, but pointed out that Diderot's encyclopedia does not show a saw among his butchering tools. As Noël Hume goes on to point out, however, saws have been used in surgery since at least the second century A.D. and their use by a butcher is certainly possible before the late 18th century. Evidence from the Spanish sites at St. Augustine indicates that saw-cut bones (see Figure 12) were present by the mid-16th century, but that the use of saws in butchering animals was a rare occurrence.

Tables 9, 10, and 11 record the frequency of cow, pig, and deer elements recovered from the three St Augustine house sites. At all three sites cow bones are predominant, and there are more of the elements present than of pig or deer. At the Contreras house use of the entire animal is indicated although the lack of these elements in the other sites may partially be a function of sample size. Nevertheless, taking the femur and humerus as elements in piece butchering packages representing the largest concentrations of meat, it can be demonstrated that the Contreras sample (Table 11) has a much higher element recovered/element expected ratio for these elements from all three animals than at either the de la Cruz (Table 9) or de la Pasqua (Table 10) sites, indicating the presence of more meat use in the Contreras household.

Another factor in element recovery and identification is cooking technique. Chaplin (1971:14) has noted that bone "roasted within the joint" loses much of its organic matter becomes brittle, and consequently preserves badly. The same conditions hold true when bones are heavily boiled, as in boiling out fat. Numerous split long bone fragments probably indicate marrow extraction, since there were few industrial uses for bone other than buttons and knife handles. Soil acidity was not a

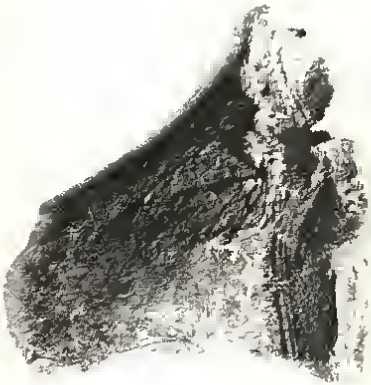


Figure 12. Left proximal radius of domestic cow, Bos taurus, from refuse pit associated with Maria de la Cruz house, SA 16-23, St Augustine, Florida. This specimen is one of the few from confidently dated First Spanish Period contexts to show butchering scars from a metal hand saw.

[illegible] Fragments at Maria c[illegible] House, SA 16-23

Element	Cow		Pig		Deer	
	Rec.[1]	Exp.[2]	Rec.	Exp.	Rec.	Exp.
SKULL						
Cranial elements	9	22		22		22
Maxilla	2	2	2	2		2
Dentary	2	2	3	2	3	2
VERTEBRA						
Cervical	1	7	1	7	1	7
Thoracic	1	13	1	14-15		13
Lumbar	2	6	2	6	1	6
Sacral		5		4		4
Caudal		19		20-24		11
RIBS						
Proximal	1	26	2	28-30		26
Distal	6	26		28-30		26
Sternum		7		7		7
SCAPULA						
Proximal		2		2		2
Distal		2		2		2
HUMERUS						
Proximal		2		2		2
Distal	1	2	1	2		2
RADIUS						
Proximal	2	2	2	2		2
Distal		2		2		2

the Tenetehara farther away from the town. Although the land on which Morro Branco was located was municipal land, the townspeople and incoming Brazilians began to demarcate plots around the village and register these plots as private property. The Tenetehara progressively lost their de facto right to use this land and therefore began to move away. Those who stayed were able to make a living only by hiring themselves to the townspeople to do such jobs as fetch water and firewood, as domestics, and as wage laborers in clearing and planting the gardens of the townspeople or the landowners nearby. Three Tenetehara women in the mid-1950s became prostitutes for the townsmen even though they continued to live in the last permanent houses of the village.

Coupled with this prostitution, a few Tenetehara men apparently resorted to begging in the streets, thus causing a scandal in the SPI Regional Office since the agent from Barra do Corda began to accuse the Grajaú agent of being responsible for this situation. Indian prostitution itself, if effected inside the village may not be a matter for great moral alarm on the part of local SPI ideology, but accusation that one's Indians are begging for food shakes the whole credibility of an agent and ultimately the image of the SPI in the eyes of local Brazilians. This accusation against the Grajaú agent, the validity of which was probably unfounded, caused the agent first, to try to marry off the Tenetehara prostitutes, two of whom he seemed to have succeeded with, and second, to eliminate Morro Branco. However, as he was transferred to another town, he did not succeed in the second instance.

To this day Morro Branco continues to be a place of lodging for the Tenetehara, but it has now shrunk to one single house structure with a roof and no walls. Even the nearby water source is now within

Table 9 Continued

Element	Cow		Pig		Deer	
	Rec.[1]	Exp[2]	Rec	Exp.	Rec.	Exp
Metapodial (indeterminate MC or MT)			2			
Phalanges	3	24	1	48	1	24

[1] Rec = Recovered

[2] Exp. = Expected/individual

Table 10. Frequency of Bone Fragments at Acosta Site, SA 13-5.

Element	Cow		Pit		Deer	
	Rec.[1]	Exp.[2]	Rec.	Exp.	Rec	Exp.
SKULL						
Cranial elements	3	22	1	22		22
Maxilla	2	2	1	2		2
Dentary	2	2	2	2		2
VERTEBRA						
Cervical	3	7		7	1	7
Thoracic	1	13		14-15		13
Lumbar	1	6		6		6
Sacral	4	5		4		4
Caudal		19		20-24		11
RIBS						
Proximal	4	26	1	28-30		26
Distal	8	26		28-30		26
Sternum		7		7		7
SCAPULA						
Proximal		2		2		2
Distal	1	2		2		2
HUMERUS						
Proximal		2		2		2
Distal	1	2		2		2
RADIUS						
Proximal	1	2		2		2
Distal	2	2		2		2

Table 10. Continued

Element	Cow		Pig		Deer	
	Rec.[1]	Exp.[2]	Rec.	Exp.	Rec.	Exp.
ULNA						
Proximal		2		2		2
Distal		2		2		2
Carpals	3	12	1	12		12
METACARPAL						
Proximal		2		2		2
Distal		2		2		2
PELVIS						
Ilium	1	2		2		2
Ischium	1	2		2		2
Pubis		2		2		2
FEMUR						
Proximal	3	2		2		2
Distal	1	2		2		2
Patella	1	2		2		2
TIBIA						
Proximal		2		2	1	2
Distal	1	2	1	2		2
Tarsals		8	1	10		8
METATARSAL						
Proximal	1	2		8		2
Distal		2		8		2

Table 10 Continued

Element	Cow		Pig		Deer	
	Rec.[1]	Exp.[2]	Rec.	Exp.	Rec.	Exp.
Metapodial (indeterminate MC or MT)	3		1			
Phalanges	7	24		48		24

[1] Rec. = Recovered

[2] Exp. = Expected/individual

Table 11: Frequency of Bone Fragments at Ximenez-Fatio House, SA 34-2

Element	Cow		Pig		Deer	
	Rec.[1]	Exp.[2]	Rec.	Exp.	Rec.	Exp.
SKULL						
Cranial elements	4	22	14	22		22
Maxilla	4	2	11	2		2
Dentary	4	2	6	2	1	2
VERTEBRA						
Cervical	14	7	4	7		7
Thoracic	17	13	11	14-15	7	13
Lumbar	11	6	5	6	5	6
Sacral	2	5	2	4		4
Caudal	2	19	5	20-24		11
RIBS						
Proximal	13	26	23	28-30	4	26
Distal	22	26		28-30		26
Sternum	1	7		7	1	7
SCAPULA						
Proximal	2	2	3	2	6	2
Distal	10	2	1	2		2
HUMERUS						
Proximal	6	2	2	2	4	2
Distal	7	2	6	2	8	2

Table 11. Continued

Element	Cow		Pig		Deer	
	Rec [1]	Exp. [2]	Rec.	Exp	Rec.	Exp.
RADIUS						
Proximal	3	2	2	2	2	2
Distal	2	2	1	2	3	2
ULNA						
Proximal	2	2	1	2	10	2
Distal	2	2		2		2
Carpals	1	12	8	12	3	12
METACARPAL						
Proximal	3	2		2	5	2
Distal	1	2		2		2
PELVIS						
Ilium	5	2	2	2	4	2
Ischium	2	2	3	2	3	2
Pubis	2	2	1	2	3	2
FEMUR						
Proximal	8	2	3	2	4	2
Distal	14	2	6	2	11	2
Patella	3	2		2	1	2
TIBIA						
Proximal		2	4	2	8	2
Distal	5	2	9	2	4	2
Tarsals	9	8	19	10	11	8

Table 11. Continued

Element	Cow		Pig		Deer	
	Rec.[1]	Exp.[2]	Rec.	Exp.	Rec.	Exp.
METATARSAL						
Proximal	5	2		8	1	2
Distal	1	2		8	1	2
Metapodial (indeterminate MC or MT)			17			
Phalanges	15	24	25	48	11	24

[1] Rec. = Recovered

[2] Exp. = Expected/individual

[illegible] and well-preserved vertebrae and cranial indicate that relatively large mammal bone preservation, particularly at the mestizo and criollo sites, might indeed be the result of cooking and secondary boiling practices. Good preservation of relatively complete portions of elements at the Contreras site may indicate lack of need to squeeze the last nutrients from bone by destructive secondary boiling.

Otto and Lewis (1974) have demonstrated conclusively that San Marcos aboriginal pottery vessels were by far the most common cooking implements in the 17th and 18th century St. Augustine, indicating the importance of puchero or olla podrida stews. Certainly these stews have correlates in Old World Spanish and New World aboriginal cooking traditions. Cooking practices and use of Old and New World foodstuffs indicate what Deagan (1974:143) has described as a complementary, adaptive process of acculturation comprised of voluntary links between mixed cultures in a frontier-garrison (Spicer 1961) situation.

Animal Husbandry

During the period of extensive cattle ranching there were strict controls on the age at which cattle were eligible for market. Governor Zúñiga, in order to increase the size of herds, ordered in 1700 that ranchers "[illegible] shall not for any reason, or purpose, or need that they may have, sell or kill any calf which has not attained more than two to three years --" (Boyd, Smith, and Griffin 1951:31). Evidence from eleewest fusion and tooth eruption on bones from the St. Augustine sites indicates that contrary to this ideal, 44 percent of the cattle were killed before age three, and that 22 percent lived at least seven years, although not all of the animals represented necessarily originated in

St. Augustine Recovery of the bones of old cattle does not necessarily indicate usage of "retired" draft animals In the 18th century, the peak of milk production occurred in the cow's sixth year, or third lactation (Trow-Smith 1957:31) Roughly 78 percent of St Augustine's pigs were slaughtered between their first and third years, with the mode occurring between 18 and 24 months Of the two sheep recovered, one was an old adult and one was a lamb approximately three months old

A great deal of potentially useful information on domestic animal bone is available from published work in the field of animal nutrition One early study revealed that

> Dairy cows that receive very limited amounts of roughage, often restricted to grasses grown on low lime sandy soils, do not obtain sufficient calcium to meet their requirements for maintenance, reproduction, and reasonable level of milk production. Cows do not decrease the proportion of calcium in the milk under these conditions Rather, they withdraw mineral matter from the skeleton to make up for that which the feed lacks Mineral is withdrawn from the bones until they are weakened even to the point that they may be broken easily (Becker, Neal, and Shealy 1931:15)

Several cattle bones from St Augustine sites show a resorption of the cancellous bone (Figure 13). In cattle and other mammals the cancellous bone acts as a reservoir for the mobilization of calcium and phosphorous under nursing or dietary stress (Maynard and Loosli 1969.164). When calcium and phosphorous are low enough in the diet to be considered deficient, mobilization occurs as well from the compact bone structure of limb elements (Becker, Neal, and Shealy 1933; Maynard and Loosli 1969 551). Excessive calcium and phosphorous deficiency (rickets) would be characterized by a bending of the ribs, buckling and fracturing of limb elements, and

Figure 13. Left: Left distal radius and ulna from domestic cow, Bos taurus, showing normal cancellous bone but exhibiting thin-walled compact bone structure characteristic of dietary calcium and/or phosphorous deficiency. Right: Right distal tibia of domestic cow, Bos taurus, showing resorbed cancellous bone structure characteristic of female animals under milking stress. Calcium and phosphorous have become mobilized without weakening or thinning the compact bone shaft. Specimen on right may have been saw-cut. Both specimens from First Spanish Period contexts, Ximenez-Fatio house, SA 34-2, St. Augustine, Florida.

enlarged joints (Maynard and Loosli 1969:166). None of the St. Augustine bones indicated this degree of dietary stress, although there are suggestions of swollen phalanges indicating marsh soil copper deficiencies (Becker, Henderson, and Leighty 1965:41).

We do not know that cattle were moved in from the more lush inland pastures and had to feed on the salt marsh grass close to the town which has less nutritional value than grasses from pastures further inland. In addition, Bartram (1942:55) informs us that both cattle and milk were scarce in the last years of the Spanish occupation. Archeological evidence tends to confirm at least to some degree the accounts of hard times, with present evidence indicating that while cattle were available for food and made up the largest part of the protein and caloric intake, there had been at least some dietary stress and sacrifice of milk-producing females.

Another thing we can learn from domestic animal bones is that chickens, particularly at the Contreras site, were often killed while in the laying season. This is documented by the presence of medullary bone in the interiors of certain long bones of female birds during the nesting and laying season (Rick MS.). Medullary bone forms in layers or amorphous clumps and when at its peak during mid-cycle fills the interior of the bone with this spongy substance (see Figure 14). Medullary bone is found most commonly in the femur, tibiotarsus, and ulna (Rick MS.). At the Contreras site, 55 percent of these elements contained medullary bone. In chickens of course the laying season is protracted, but there is nevertheless clear evidence that over half of the chickens consumed at the Contreras household were at the time producing eggs. One of the two

Figure 14. From top: left distal femur, right proximal tibio-tarsus, and left proximal femur of domestic chicken, Gallus gallus, showing formation of layers and the amorphous structure of medullary bone, a spongy substance formed within the cavities of certain long bones of female birds during the nesting and laying season. Medullary bone should not be confused with the thin, bony support struts normally present in the long bone cavities of birds of both sexes. Specimens from First Spanish Period refuse pits, Ximenez-Fatio house, SA 34-2, St. Augustine, Florida

chickens at the Cerro de la Costa house was killed during the laying season, and some from the Gertrudis de la Pasqua site.

There are a variety of explanations for this sacrifice of producing hens. The least tenable is that at the Contreras house where we have a large sample, his flock was so numerous that the productivity of an individual chicken at any one time was of no concern. More plausible is that this is further evidence of hard times, where chickens were killed for short term gain rather than for the long term benefits of egg production. However, the age of the individual chickens under question argues against this explanation, and the best conclusion may be that chickens were killed as they neared the end of the laying season and egg production was decreasing. In this approach the chickens would not have to be fed over a period of months when they produced no eggs. Only one of the bones recovered was choked with medullary bone, so the others may well represent chickens killed past the peak of egg production.

Fishing

In the brief discussions of individual sites great similarities were noted in both the species composition and contribution to the diet. The major difference observed was the specialization on large drum at the Contreras house site. Drums (red and black) represent the largest fish contribution by weight for all of the St. Augustine sites combined (40 percent), followed closely by sharks (30 percent). Mullet are most commonly represented (40 percent of the total MNI), although only third in total weight contribution (14 percent). Catfish and sheepshead are the other important species.

Little biological work has been done on estuarine populations in the immediate St. Augustine area, but 75 miles to the north, St. Andrews Sound and adjacent coastal rivers and tidal creeks have been extensively sampled by Georgia fisheries biologists (Mahood et al. 1974). Certain differences would be expected due to variations in local conditions, but in the main the data presented in their study are considered highly analogous to St. Augustine's estuarine populations. The Georgia study, in combination with earlier work by Bigelow and Schroeder (1948), led to the development of Figure 15 which indicates the greatest seasonal abundance of represented species.

Casteel (1974) has demonstrated the application of fish scale analysis to questions of seasonality. Relatively rapid scale growth occurs primarily during the warmer months with annular ridges from slow growth formed during the winter. The examination of fish scales from the St. Augustine sites is especially pertinent when viewed in light of fish availability as represented in Figure 15. Examination of the scales shows that fishing took place largely in the fall and winter, while maximum fish availability occurs during April and May and August and September (although the fish identified thus far from St. Augustine sites can be caught at any time of the year). Possibly fishing was most intensive at this time due to a drop in availability of other resources. Catfish and sharks do not have scales and thus we have no empirical evidence for the seasonal catch of 35 percent of the fish contribution by weight.

Although the documents indicate that barrels of salted herring were shipped into St. Augustine (Harman 1969 Appendix I), no herring bones were found at the sites. This is quite possibly due to the recovery

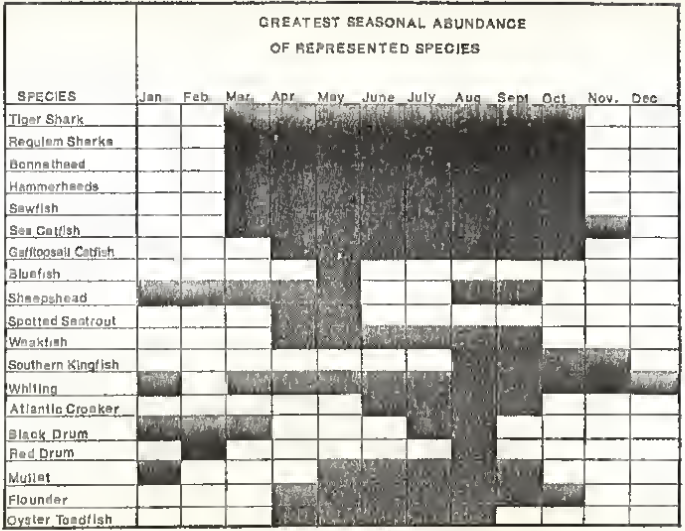


FIGURE 15. Greatest Seasonal Abundance of Represented Fish Species.

techniques employed. Although the de la Cruz and de la Pasqua materials were water-screened through one-quarter-inch mesh (the Contrarsa excavation used a larger mesh), herring bones are often missed unless screened through one-eighth-inch mesh (Rochelle Marrinan 1969 personal communication).

There is some disparity between the historical accounts of increasing dependence on coastal resources and the scarcity of domestic meat, and what is reflected in the archeological record. Comparison of the three St. Augustine sites by various traditional methods shows that one could actually prove this point either way, depending on the methodology employed. Use of fish resources at the three houses averages 61.8 percent when figured on the basis of MNI, 48.9 percent by fragment count, 7.8 percent by fragment weight, 11.1 percent by biomass (edible meat) based on MNI figures, and 9.4 percent by biomass based on bone weight. The latter two figures are in close agreement and are considered to reflect most accurately the percentage contribution to the diet of fish. Fishing was entirely within the estuarine habitat as opposed to 18th century Spain where offshore fishing was predominant. Only rarely are fish cranial elements present. This seems to follow market patterns noted in Spain, where fish were gutted and beheaded before being sold.

Hunting and Collecting

As the Spanish in the mid-18th century became more restricted to the fields, pastures, and marshes adjacent to St. Augustine by British-Indian attacks, their subsistence system was regulated even more by mechanisms which Flannery (1971:351) has identified as seasonality and scheduling. Seasonal availability of wild resources is imposed on man by nature,

whereas scheduling is a [illegible] with [illegible] conflict between procurement systems based on seasonal availability. For instance, when agriculture becomes important, planting and harvesting seasons may interfere with seasonal availability of certain wild resources, such that rescheduling occurs and the wild species are no longer hunted or collected.

In this regard we can examine use of wild resources by inhabitants of the St. Augustine houses. Birds provide the best seasonal and habitat data, and indicate that at least the inhabitants of the mestizo household spent some time foraging or trapping in the winter. The blue-winged teal, long-billed curlew, dowitcher, and snipe all occur on either the beach-dune or salt marsh-tidal creek life zones from early fall through spring (Robbins et al. 1966), largely a time of agricultural inactivity. The long-billed curlew (Numenius americanus) is the largest of the shore birds, but no longer occurs on the Florida coast. It was formerly an abundant migrant until extirpated in the late 19th century (Sprunt 1954: 170). The hooded merganser is also a winter resident but would be found further inland around wooded lakes and streams. The criollo household remains produced one unidentifiable wild bird. The Contreras sample included bones of the willet, a year-round resident who winters in the salt marshes and the gannet, a large winter migrant who frequents offshore areas and congregates around fishing boats (ibid., p. 17).

None of the wild mammals present are particularly seasonal species, although deer tend to occur in groups during the winter mating season and either singly or as does and fawns during the summer and fall (Burt and Grossenheider 1964: 230). What is perhaps more of interest here is the

time of day during which the represented wild mammals are available. The opossum, raccoon, fox, rabbit, and bear are all more active nocturnally. The opossum, raccoon, fox, and rabbit are species readily trapped, although no metal trap hardware was found in the St. Augustine sites. It is of interest that the opossum, raccoon, and fox are occasional crop and poultry pests (Hurt and Grossenheider 1964) and may have been taken actually in or close to town. Deer and bear are best taken by hunters either during the early morning or early evening hours and were almost certainly hunted away from town, probably on the edge of the mesic hammocks some distance inland. These are the only mammal species which would probably have interfered with time spent in agricultural or military activity, for although they would normally be hunted at dawn and dusk, the time spent in travel to suitable localities, in hunting and field-dressing, and in scouting the area for British or Indian adversaries might preclude all but a full-time hunter or hunters from this activity.

The most frequent reptile species in the St. Augustine sites, the gopher tortoise, is most easily collected early to mid-morning as it emerges from its burrow to feed (Conant 1974: 72). The coachwhip snake identified from the de la Cruz site is a frequent resident of gopher tortoise burrows and inhabits the same high pine, sandy woods (Carr and Goin 1955: 273). Other inland reptile species found include the chicken, yellow-bellied, and snapping turtles which occur in ponds, sloughs, streams, and rivers, and the box turtle which is a frequent resident of mesic hammocks. Diamondback terrapins are common in tidal creeks and estuaries.

In summary, an examination of seasonality and scheduling as reflected in animal hunting and collecting by residents of the St. Augustine households

[illegible] conflicts with the agricultural cycle. Use of near by [illegible] birds is indicated as a winter food source, primarily at the mes- [illegible] house This hunting or trapping occurred during the seasonal break in agricultural activity and coincided with greater bird species availability Mammals were probably taken year round, with some species probably trapped in or near town in poultry yards or agricultural fields. Deer and bear were probably taken by professional hunters some distance away from St. Augustine The regular presence of gopher tortoise, deer, and the occasional representation of bird or reptile or mammal species indicative of inland freshwater pond, river, and mesic hammock life zones implies there was continuous foraging and hunting in areas often frequented by hostile British and Indian patrols Late winter and early spring before the first crop was harvested would have been the time of greatest food scarcity, and it may have been at this time that the risks were taken to obtain many of these wild vertebrate foods Further supportive evidence of scheduling and its indication of the importance of agriculture may be the fall-winter catches of fish as revealed by scale analysis.

Energy Flows in St. Augustine

Any study of man and the environment of which he is a part is a study of systems Natural systems are composed of a series of compartments which take in and disperse solar energy along pathways, using it for main- tenance and growth, social systems, centered around man, use solar energy indirectly by using various compartments of these natural systems (biotic communities) for food (maintenance) and growth.

Analysis of the relationships between the natural and social systems is facilitated by diagramming or modeling. Energy flow diagrams pioneered Howard T. Odum (1971) are one way of explaining these relationships visually. The major study of anthropologists is man, yet he cannot be studied apart from his physical environment. The energy flow diagrams make us take into account the pathways by which man's food reaches him, and how this food energy is dispersed through the social system. Basically man's food energy comes from green plants, either directly or through consumption of herbivores (or even more indirectly, carnivores). This simple relationship is maintained but further complicated by interactions resulting from the increasing complexity of social systems.

Watson, LeBlanc, and Redman (1971:65) have pointed out that the "—. systemic view of culture with its multivariate approach and emphasis on relationships and variability — should be the interpretive framework of scientifically oriented archeology." In this regard the energy flow diagram is very important as it makes aware of the relationships between cultural and natural systems. In a relatively complex situation like colonial St. Augustine, man-land relationships are basic as they are in any society, but we have economic systems that must be figured in as well that are important to the subsistence base. The fact that St. Augustine was consumer society and not involved in export to any significant degree makes it of particular interest.

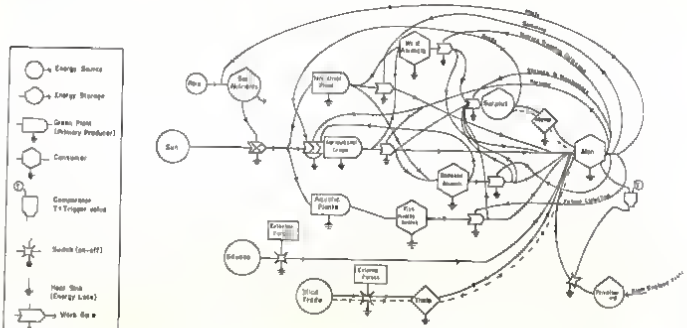
The sources of St. Augustine's food supply seem to have been in almost constant flux, and to represent the subsistence systems in operation from the start of the colony in 1565 until the occupation by the British in 1763 would require a number of diagrams. The particular time

[illegible] here is that [illegible] of time in the late 1750's and early [illegible] for which we have controlled archeological data, and adequate documentation of minimal input from the situado, some trade with the British, occasional privateering, agriculture and livestock herding circumscribed to within a mile or two of the town, and some fishing and hunting. Figure 16 is, then, a synchronic view of subsistence and related economic systems present in St. Augustine about 1760.

When one learns to read the symbols the diagrams is less confusing and can actually clarify the working relationships present in St. Augustine society at the close of the 1st Spanish period. The circle represents an energy source outside the system which the system can draw on but which cannot be exhausted. The "roofed" semi-circle represents energy which is stored within the system or within one component of the system, and which can be exhausted. The bullet-shaped symbol is indicative of a primary producer (anything that does photosynthesis), or in other words, green plants. The hexagonal symbol is the consumer, or anything with the ability to consume energy, make structure of it, grow, or reproduce. The symbol labeled as a switch indicates an intermittent or otherwise non-constant (on-off) energy flow, in this case, external trade and the arrival of the situado. The combination of symbols identified as a comparator is similar to the switch, but a trigger valve acts to operate another energy pathway when supplies get to a certain level. In this instance privateering is stimulated by low food supply in St. Augustine. Successful privateering resulted in energy input from external sources; that is, French and English ships.

The downward pointing arrow of the heat sink depicts the system in conformance with the second law of thermodynamics, which involves loss of some energy to non-available heat with every energy transformation. The work gate symbol illustrates the interaction of two energy flows such that the resulting third flow or output is something different from the energetic inputs. The symbol labeled as an economic transactor indicates a flow of cash and goods, usually in opposite directions. The rectangular box symbol is a catch-all for unspecified functions, in this case external climatic, military, or political forces controlling the arrival of the situado and trade with the British.

The energy flow diagram doesn't necessarily tell us anything new, but makes us account for all energy expenditures and therefore makes us more careful in our statements concerning these relationships, whether in a contemporary or in a prehistoric or historic community. Ideally, numbers, expressed in kilocalories, would be affixed to these symbols so that the system can be analyzed quantitatively. When numbers can be put on this diagram and the specific contribution or energy drain of any activity clearly seen, then we will feel we truly understand the relationships and interactions between components of the social and natural systems in colonial St. Augustine.


Energy Source
Energy Storage
Gross Flow (Primary Producer)
Conveyor
Conveyance T = Trigger value
Switch (on-off)
Heat Sink (Energy Late)
Work Gate
Resource Interface
Flora
Sun
Soil
Bay
Sea
Fish
Shellfish
Animals
Man
Fresh Water
Salt Water
Fishing
Hunting
Gathering
Agriculture
Trade
Tribute
Taxes
Labor
Capital
Energy
Money
Exports
Imports
Colonial Power
Tribal Pride
Religion
Education
Government
Military
Police
Courts
Prisons
Roads
Bridges
Ships
Boats
Canoes
Houses
Forts
Churches
Schools
Libraries
Hospitals
Markets
Warehouses
Factories
Mines
Farms
Ranches
Orchards
Vineyards
Gardens
Parks
Zoos
Museums
Theaters
Stadiums
Arenas
Airports
Seaports
Railroads
Highways
Bridges
Tunnels
Canals
Dams
Reservoirs
Wells
Pipelines
Power Plants
Transmission Lines
Telephone Lines
Radio Stations
Television Stations
Newspapers
Magazines
Books
Libraries
Schools
Universities
Research Institutes
Laboratories
Observatories
Planetariums
Aquariums
Zoos
Parks
Gardens

SUMMARY AND CONCLUSIONS

At the outset of this paper an effort was made to delineate the heritage and patterns of 16th-18th century Old World Spanish foodways. Agricultural crops and techniques, animal husbandry, hunting, fishing, food preparation techniques and availability, and cooking and food preparation techniques were all discussed and evaluated in order to outline specific testable implications applicable to the nature of the foodways of Spanish colonists in the New World. Analysis of historical documents and archeologically recovered floral and faunal remains and associated items of material culture from New World Spanish colonial sites formed the tests of these implications. Results of the tests were seen as a means of describing the degree of Old World subsistence system tenacity in the face of natural and cultural environmental changes, specifically Spanish-Indian acculturation as it related to foodways.

The basic assumption here was that deviations from known Old World Spanish subsistence patterns can be quantified by recording the relative dietary contribution of wild animal and non-European plant foods in New World colonial sites, thus dietary remains will reflect the nature and degree of acculturation.

The series of implications of the transfer to the New World of Old World Spanish foodways and the results of the tests of the implications are as follows:

(1) [illegible] reflected Spanish models in regard to economic crops, [illegible] field shape and type of plowing, and home gardens and orchards, then evidence should exist for major use of wheat and other cereal grains, peas, beans, and numerous fruit trees. Economic crops should be raised in square-shaped fields plowed by oxen. House lots should include space for gardens and fruit trees.

Results. Evidence from the New World confirmed the presence of major European cultigens, supporting in part the first implications, but underscored the much more significant contribution to the diet of aboriginal crops, in particular maize and cassava. Spaniards were unwilling to do without wheat, and arranged to import it if it would not grow locally. Nevertheless, the plant foods characteristic of the diet of the Spanish colonists in the New World were maize, beans, squash, peppers, and cassava, all of New World origin, plus melons, figs, and various fruit trees common to Spain. The combination of these foods stresses the importance of Spanish-Indian acculturative processes and local natural and cultural environmental factors.

At first the Spaniards were willing to let local aborigines supply plant foods grown by native techniques, but soon the depletion in their numbers and the reluctance of aborigines to supply food to the Spanish led to the importation of Spanish farmers and presumably Iberian agricultural techniques. The first years were unsuccessful and hoes were the main agricultural implement, later oxen and plows were introduced and fields became larger and square-shaped as in Spain. In Florida by the mid-17th century there are documentary references to iron plowshares which may represent moldboard plows and not the Mediterranean scratch plow

characteristic of Renaissance Spain. The Mediterranean scratch plow had been improved over the years to the point where it was drawn by oxen and had a metal tip or colter which cut the soil, but moldboard plows had three principal parts, a metal colter to cut vertically, a metal plowshare to cut horizontally, and an angled moldboard which turned the cut slices of topsoil over to one side. The moldboard was larger and more expensive and was pulled by teams of up to eight oxen. Fields became larger and cooperative farming became necessary where it was used in Europe (Tannahill 1973:190-192). Evidence from the inventory of Governor Vallezilla's wheat farm (see Appendix A) which had six leagues of cultivated land, 22 team oxen and a number of iron plowshares is at least suggestive of this technique, which was not common in Spain. However, fields around St. Augustine itself depicted on maps of the period suggest no evidence of moldboard plowing.

Where we have data, as in 18th century St. Augustine, house lots include space with gardens, orchards, arbors, and yards and outbuildings for small domestic animals. This seems to have been a direct transfer from peninsular Spain, particularly of the Mediterranean and Atlantic coastal regions.

Agricultural techniques seem to follow closely Old World Spanish models, supporting the implications of transfer of Iberian systems to the New World, but the major food crops were clearly aboriginal. (Sugar, an economic crop widespread in the Caribbean, was introduced). New World agriculture, then, follows an acculturative model, the process of which might be termed fusion (Spicer 1961:530), involving the combination of elements from two or more cultural systems into a single system, distinct from the parent cultures.

(1) [illegible] followed the economic and dietary use pattern of Spain, then one the animal bones should include, in order of percentage representation, sheep, cattle, pigs, chickens, goats, an assortment of domestic fowl such as ducks, geese, doves, and pigeons, and should represent the major animal dietary contribution.

Results: The predominance of sheep in the diet and as an economic force in Spain did not carry over into the New World. Sheep could not compete with cattle and pigs, and only seem to have retained importance in protected flocks near cities like Santo Domingo. It is ironic that the worst predators of sheep were packs of feral Spanish dogs. Another discriminating against sheep was the New World economy. The mines in the Caribbean and Terra Firma, the first areas of European impact, allowed rapid monetary gain as opposed to the slower process of growing wool. Goats are mentioned frequently in the early documents but have yet to be positively identified from Spanish colonial sites in the area under consideration. Cattle, in particular, flourished on New World pastures, so much so that they were often killed for their hides alone. Pigs and chickens maintained their Old World status as backyard animals and were valued additions to the diet. Domestic animal meat seems to have been more generally available in the New World than in Spain, where vegetable foods contributed heavily to the diet, especially of the lower classes.

Other than the relative order of importance of individual European domestic animal species, little changed in the New World, confirming the implications of transfer of Old World domestic animal use patterns. A combination of natural and cultural (economic) environmental reasons made

cattle of far greater importance than sheep. Other than the dog, there were no important circum-Caribbean aboriginal animal domesticants. Aboriginal use of European domestic animals in the area under study followed Spicer's (1961: 530) assimilation model, in which the recipient culture accepts and assimilates items from the dominant (or in Foster's (1960: 11) terms, "donor") culture in terms of the meaning in the donor culture. Acculturation then, was largely Spanish to Indian regarding domestic animal use.

(3) If hunting and collecting of wild foods was limited and showed concentration on very few species as in Spain, then bones of wild animals should be scarce in New World colonial sites. Those species that are present should be principally deer, rabbit (hare), birds of the upland scrub, and coastal birds and their nestlings.

Results. In the New World sites use varied from a high of approximately 18 percent (by weight) use of wild animals at the Contreras house in St. Augustine to almost no use at the Convento de San Francisco. At the St. Augustine sites wild mammals and birds were a minor but important food resource, perhaps attaining a larger proportion of the diet when domestic food sources were scarce. Deer and other wild foods may have been marketed in St. Augustine.

Species composition of wild foods differed considerably from Spanish models, particularly in St. Augustine, deviating from the implications of transfer of Old World patterns and stressing the importance of acculturative factors since the pattern more closely resembles aboriginal usage of wild foods. In this light the Convento de San Francisco, with no aboriginal interaction and hence no real chance for continuing

[illegible]rative influences, as seen as the site representing most closely [illegible] World Spanish models. The manatee and iguana, like the Old World "lauricea," were probably special Lenten foodstuffs since they were not considered as meat.

The picture is St. Augustine is confused by a literal interpretation of the figures reflecting wild animal usage which do not differentiate between market availability to those of higher status (like Contreras) of wild foods during periods of dietary stress, and actual collectios of diversified resources which was probably the case in the mestizo household. In this regard the diversity indices (Appendix E) may be helpful, and tend to link the mestizo household more closely with aboriginal food procurement patterns. Evidence from the sites studied would indicate that differences in use of wild foods is a function of the degree of aboriginal participatios in Hispanic culture.

(4) If fishing concentrated on commercially-obtained pelagic, deep water marine species taken by a variety of fishing hardware as in Spain, then bones of large, deep water species should be present, although bones of the cranial region should be rare due to market preparation. Fishing hardware should be scarce unless sites are linked to a commercial fishery, where professional hardware is present it should include large line and set weights, barbed and unbarbed hooks in a variety of sizes, brass wires, and netting tools. Subsistence fishing should be represented by small hooks, lead line weights, and small set weights.

Results: Fishing shows perhaps the least resemblance to Spanish models. Spanish fishing concentrated on deep water and pelagic species, using both leaded lines and hooks and a variety of nets. In the Caribbean

only occasionally were deep water species part of the Spanish diet, in Florida there is evidence for a commercial fishery based entirely on selected estuarine species. Foster (1960 34) suggests that the great variety of fishing techniques in Spain is a response to varied fauna and marine and climactic conditions. There is certainly a great amount of variation in circum-Caribbean area fish fauna and habitats, yet the Spanish concentrated on the inshore pelagic and estuarine zones. A factor not accounted for might be the possibility of a lack of offshore boats in common supply available for fishing, and the hazards to unescorted vessels from English and French privateers. One similarity to Old World Spanish techniques is in the preparation of fish for market. Spanish fish were sold headless and eviscerated, in the New World sites crucial elements were rare, possibly indicating rather widespread market accessibility.

The low incidence of fishing hardware from New World sites neither confirms nor rejects the use of items similar to those used in Spain, but evidence from the Jefferys map of St. Augustine (Roberts 1763) shows what appears to be a weir, a fishing technique not employed in Spain. Since weir fishing is a documented aboriginal trait, it is probably that either the techniques were learned from Indians or mestizos or that members of one of the latter groups operated the weir. Most species represented in St. Augustine sites are easily taken with hook and line, and mullet, also found in Spain, would be most easily taken with an atarraya, or cast net. Mullet remains are not a common constituent in aboriginal middens, but the presence of large numbers of mullet and possible net weights at the St. Augustine mestizo house indicates some degree of acculturation and subsistence fishing (as in Spain) by the household inhabitants

The results are clearly not supportive of the implications of the wholesale transfer of Iberian fishing practices, although there are some similarities to Old World Spanish models. The data are, however, supportive of acculturative processes in operation. Apparently New World Spanish fishing techniques are largely a process of fusion whereby Spanish practices of preparation, marketing, and subsistence fishing were combined with common aboriginal fishing techniques and species and habitat exploitation.

(5) If Spanish models of cooking were followed, chiefly in preparation of meat and vegetable stews and use of large quantities of oil and wine, then the great majority of cooking vessels should be utilitarian earthenware pots. Few bones should show charring on the ends resulting from roasting practices. Container jars should be present for the storage of oil and wine.

Results. The great majority of Spanish cooking vessels were utilitarian earthenware vessels in which they simmered their puchero or olla podridas. Coarse Spanish utilitarian earthenware pots were the common cooking ware at the Convento de San Francisco, but at the St. Augustine sites and possibly at Nueva Cadiz, the functional equivalent became locally produced aboriginal pottery. San Marcos sherds are often recovered from archeological sites in St. Augustine encrusted with charred food. Generally poor large animal bone preservation suggests boiling as a cooking technique, and the scarcity of burned bone argues against much use of roasting.

The Spanish were fond of olive oil, wine, and olives in brine, and the presence of suitable containers for these liquids was expected in New World colonial sites. John M. Goggin's (1960:6) classic study of the

[illegible] importance of these vessels in their primary role as storage and transport of liquids and secondary use as containers for dried beans and other vegetables or as water jars. Glazed and unglazed olive jar sherds are ubiquitous in New World colonial sites. Olive jars seem to have had their aboriginal counterparts in storage vessels, and they appear wherever there was Spanish-Indian contact, suggesting perhaps at least some aboriginal use

Traditional Old World modes of cooking did transfer to the New World, although the techniques were very similar to aboriginal methods. Acculturative mechanisms were at work here, with the process defined as fusion. New World plant foods and Old World domestic animals combined to form the stews, which were cooked in either aboriginal or Spanish earthenware

(6) If Spanish Lenten season dietary habits were reflected in household midden debris, especially in lower-class Catholic homes, then accumulations of fish bones and possibly plant food remains should occur in distinct from normal eating and discard patterns which should result in higher percentages of domestic animal bone-

Results Lower class peoples would not be expected to have the extra money with which to buy an indulgence allowing them to eat meat. From the material culture remains, none of the excavated homes at St. Augustine obviously belonged to economically lower class people. The criollo site did show the only suggestions of confirmation of the implications of a special Lenten diet, with some pits containing very high proportions of fish and other almost exclusively domestic animals. Fish constituted a total of about 10 percent of animal biomass here and at the other sites in St Augustine

[illegible] to adequately [illegible] the [illegible] implications, as other explanations are equally plausible, such as differential food availability. Fish were of major importance only at the Nueva Cadiz site, the pearl-fishing village, and were so frequent as to confuse the issue. At the Convento de San Francisco, headquarters of the Franciscan Order, fish remains were relatively scarce, although this may be more a reflection of Goggin's recovery techniques than the friars' carnivorous propensities.

(7) If social class differences were reflected in the diet as in Spain, then there should be an increase in the relative percentages of meat and fowl with increasing social status.

Results: This is perhaps the most difficult of the implications to assess. At St. Augustine where there was the only opportunity to make distinctions based on either ethnicity or wealth or some combination thereof, the picture is not immediately apparent.

Christoval Contreras was clearly wealthy by St. Augustine standards, but other than the fact that his midden debris reflected better cuts of meat and larger fish there is not much to be said from traditional analysis. If higher percentage of domestic animal meat consumption based on bone count and weight is any indication of status, then he clearly loses in the contest against Maria de la Cruz' mestizo family and Gertrudis de la Pasqua's criollo household, though the most notable species difference is the number and variety of domestic fowl from the Contreras site.

The one variable which might aid in interpretation of meat percentage in the diet, but over which we have no control, is the plant food intake, and we would be hard-pressed to discern archeologically or analytically

a difference [illegible] of a puchero that contained one fish, a ham hock, and 80 percent corn beans, and water, and an olla podrida which contained three fish, three ham hocks, and 40 percent corn, beans, and water. As long as the fish to ham hock ratio were approximately the same, we would be unaware of the much greater proportion of meat in the diet of the family cooking the olla podrida, unless we knew much more precisely the length of occupation of the sites and the proportion of the deposition which our sample represents. However, the presence of bones reflecting choice or "meaty" cuts gives some clues that the Contreras stews had more meat in them than would be indicated by a simple bone count. In addition, his higher status and wealth may have enabled him to purchase imported salt beef or pork, much of which would presumably be bone-free, leaving us without tangible archaeological clues to a diet higher in meat content.

There remain great similarities in the dietary pattern of the three mid-18th century households in St. Augustine. Perhaps the best explanation of this apparent similarity was presented by Otto and Lewis (1974:115). Throughout its history as a Spanish frontier garrison, there were few women immigrants to St. Augustine. This factor resulted in men of varying status and ethnic or geographic origin marrying local criollo, mestizo, and Indian women. Since it has been suggested that women were primarily responsible for food procurement and cooking (Deagan 1974:40, 80, 84), this acculturative process, strengthened by voluntary liaisons or marriage bonds, possibly minimized status-related food preparation and dietary pattern differences. There are only suggestions of the confirmation of the implications of the transfer of Old World status-related foodways, mitigated by local acculturative factors.

By the mid-18th century [illegible] ation was no longer one of directed change as it had been in the mission period. In St Augustine the process was reciprocal, largely through voluntary links between members of aboriginal and Spanish or criolla society (Deagan 1974:143). Foodways reflected this blending of cultures, largely through the process Spicer has described as fusion

Flannery (1971:356) has argued that deviation-amplifying (positive feedback) processes are the real mechanism of culture change. In the New World, the concept of the early colonist of recreating or transplanting Castilian society and its subsistence base in a new natural and cultural environment did not entirely succeed; yet the fact that there is a contemporary, vibrant Hispanic American culture in the New World indicates that successful adjustments were made. The process of Spanish-Indian acculturation, particularly in the food base which became composed largely of aboriginal cultivated plants and European domestic animals, is seen as such a positive feedback system, one which must be considered adaptive.

APPENDIX A

1651 Description of a Florida Wheat and Cattle Farm

(Translation of Archivo General de Indias, Escribanía de Cámara, Legajo 155(B) fll, from photostat in Stetson Collection, U F.)

by

Daniel J J Rose
University of Florida

(Report) of the agreement that was made on the 5th of September of 1651 by the contador Nicolas Ponze de Leon, who is acting as governor of these provinces due to the death of the proprietary (governor), and Salbador de Zigarroa, who is in charge of the royal treasury, on the purchase of the plantations of land and labor, and other effects that are in it, belonging to Don Luys de Salazar Vallez(ill)e, son, and executor and heir, of Benito Ruiz de Salazar Vallez(ill)a, former governor of these provinces for his Majesty.

On September 5, 1651, Captain Nicolas Ponze de Leon, Governor and Captain-General of these provinces, at the same time chief treasury official and judge of his Majesty's court, and Sergeant-Major Salvador de Zigarroa, official treasury-Judge of these provinces - gathered to discuss affairs of royal service, as by law and custom, among other things (we discuss) the death of Sergeant-Major Benito Ruiz de Salazar Vallezilla, Governor and Captain-General of these provinces, leaving a farm where wheat and corn are grown, adjoining the pueblo of Asile, that which we therefore offered (for sale) many days But no purchase has been made, as the land is very poor and all the Spaniards who are here

are soldiers and have no funds to buy it, and then to sustain and improve (it), because if the said hacienda is put in order and occupied (it would be) at great cost, as was done by the said Governor, as is well-known It is said to be entirely destroyed and forsaken and (they) cannot set it up as the governor intended, to supply flour for royal service, so that the supply of bread will be ensured for the infantry and the missionary friars who are here in the conversions. We now depend on that brought in by ship, endangered by shipwreck and robbery by our enemies, by which we lose a great deal. Therefore when the supply does not come, many perish of hunger and others go in desperation to hunt the beasts of the woods, in such a manner that by the bad food they are weakened and come to the point of losing their lives as did the others. These great losses damage the royal treasury, because all that is carried and brought to this presidio for the maintenance of the infantry and the religious is on the account and at the risk of his majesty, and has already put the treasury to a very great expense. The only lack is of a mill in which the flour that is harvested may be ground, and now we have an official who can make a mill and bring the stones for it. By the experience that he has, of more than six years in this place, (he knows) the fertility of the land which is more fertile and better than that of Spain, and has no mountains, and will produce much grain.

(Therefore) by the general usefulness of this land, and for the increase and security of the Royal Treasury, it appears wise that the said hacienda be purchased by the Royal Treasury of his Majesty. So that the payment for the said sowed land can be put off into the future and his

Royal Majesty not [illegible] it by sending money or writs from the sitiado, [illegible] that the production of the same hacienda be attended to with attention and care, so that in a short time its production will meet the cost and payment (for itself). Before a few years pass, the utility and increase for the Royal Treasury of the purchase of said wheat hacienda and its labor will be revealed and known. In conformance with their orders, they called for Captain Don Luys de Salazar Vallecilla, who is in the infantry of this presidio, son, executor, and heir of the said señor Governor, and who being present and openly treating and conferring in connext about the said labor in wheat-growing of the slaves, the larger and smaller livestock (ganados mayores y menores), the tools and other things that are in the said hacienda, they are agreed together in the form and manner that follows

List of what is included in the purchase

first, 22 large team oxen (bueyes grandes de casar), at 40 pesos each, for 880 pesos;

next, 8 horses at 100 pesos each, for 800 pesos,

next, 45 head of swine, at 4 pesos each, for 180 pesos,

next, for a wooden table, 4 pesos,

next, for a used whetstone, 4 pesos, I say 8 pesos;

next, for 6 wooden benches, 6 pesos,

next, for an oil lamp, 1 peso;

next, for a machete, an auger, and a lance, 4 pesos,

next, for 3 wooden beds, 6 pesos;

next, for 13 used iron plowshares, 117 pesos,

next, for 4 used spades, 8 pesos,

[illegible], for [illegible] 21 pesos,

next, for 8 sickles, 13 pesos,

next, for an old bottle-case, 2 pesos,

next, for 2 posts (?) (mastiles), 5 pesos;

next, for 4 augers (or bits), 4 pesos,

next, for 3 hand adzes, 9 pesos,

next, for 2 saws and a small handsaw, 5 pesos;

next, for 4 carpenter's planes, and 2 carpenter's planes (two [illegible] cepillo and jumtera), 14 pesos;

next, for 2 used table-cloths, 5 pesos,

next, for 4 eel-hooks (anzuelos de corbinas, refers either to Mediterranean eel or drum fish), 2 pesos,

next, for a pewter dish, 2 pesos,

next, for 2 machetes, 4 pesos,

next, for 2 bricks of chocolate, 5 pesos,

next, for 8 used iron goads, 24 pesos;

next, for 2 iron chains, 8 pesos;

next, for a Negro named Ambrosio, from Angola, aged 30, 500 pesos,

next, for a mulatto named Francisco Galindo, who is now overseer of the hacienda, 600 pesos,

item- for a large living-house, made of good wood, with a kitchen of the same house, with an oven and 2 foot-mills constructed of wood and another large house of pela, where they keep the flour, and a good pasture where they keep the large livestock, and another new house, with its earthen walls covered with palm, and 6 leagues of land belonging to said hacienda, with the tillage that was, a little more or less, about 30 fanegas of wheat seed and 14 arrobas of maize seed Land is broken (by plow) and worked by all together and is worth 1,000 pesos of 8 reales each in the following form, 500 pesos of it for the houses, pasture, and all the buildings, and the 500 pesos remaining for the 6 leagues of land and tillage that are plowed at the said hacienda, with these sums referred to, amounts to 4,259 pesos

[illegible]

At the same time, agreeable to both parties, [illegible] the reasons and causes referred to at the beginning of this agreement, and that it is convenient to provide a sure supply of meat, so that it can be provided without so much risk as by calling on Havana and other parts of the Island of Cuba, (we agree) that the said captain don Luys de Salazar (provide) up to 70 head of cattle (reses bacunas), the majority of them female, that (they be put) in the 6 leagues of this hacienda where there is a rustic (?) (bato) put there by the said señor governor for the care and increase of the said cattle. And openly treating and conferring on the price for the said livestock, it was decided and agreed that the said captain be given 21 pesos for each small animal, as well as for the large ones, and the same for the females. The sum is to be paid for by order of payment (libranza) written in due form on the person or persons in whose charge are the collection of monies (cobranzas) from the situado of this presidio. And equally that the referred to 4,259 pesos of 8 reales be paid in libranzas of the same form, for the cost of the said hacienda, labor in wheat of the slaves, livestock, and other materials that have been listed. For which there is made the deed of transfer and contract by the said captain don Luys de Salazar in favor of His Majesty, and the said señores Governor and Treasurer are obliged to pay for and satisfy it in the name of His Majesty, and give and surrender the like libranzas to the said captain, in completion of this said agreement, their honors sign it with the said don Luys de Salazar Vallezilla

Nicolas Ponze de Leon - Salbador de Zigarroa - Luys de Salazar

Vallez(illa)

Is a copy of the original agreement that is in the book of them in the treasury office of my charge, of these provinces, which I remit this date In St Augustine of La Florida, April 25, 1656

(signed) Sanchos de las Heras

APPENDIX F

Inter-site Comparison Diversity Measures

Inter-site comparison is based on the Shannon index of species diversity (Shannon and Weaver 1949:20). Originally developed from information theory to predict the occurrence of transmitted message "bits," the formula has since been slightly modified and widely applied by ecologists concerned with community structure. The formula as presented here follows the form used by more recent investigators (MacArthur and MacArthur 1961 594):

$$\bar{H}' = - \sum pi \log_e pi$$

where $\bar{H}'$ = species diversity
pi = number of ith species divided by sample size

The application of species diversity measures to anthropological data on human nutrition demands a restructuring of goals. Rather than measuring community structure, the number of species present and the number of individuals in each species within a community, the feeding niche is being measured. In other words, out of the total biological community, human beings are selecting a variety of foods. The formula expresses the breadth of this feeding niche and its concentration on particular species as one number, enabling comparison of food selection practices between groups.

There are numerous diversity indices, but the Shannon index is used here since it is sensitive to both species variety and species dominance, and is relatively sample-size independent, allowing comparison of various sized samples (Sanders 1968:279). The Shannon index actually has two

components, [illegible] measures of diversity and species evenness or equitability (E P Odum 1971 149). Maximum possible diversity would be 4.61 in a case where 100 individuals each represented a different species, and lowest at 0.0 when all individuals represented a single species.

The first use of this index applied to archeologically derived materials was by Elizabeth S Wing (1963 55), who recently computed diversity values for a large sample of Southeastern aboriginal sites (Wing 1973b). Diversity and equitability values were computed for sites discussed in this paper and are presented here in tabular form. In the St Augustine sites diversity and equitability were also computed substituting biomass represented (edible meat) for minimum numbers of individuals.

Diversity indices can't really measure anything new, and misapplication of the data can easily lead to erroneous or subjective conclusions. For instance, Levins (1968 35) has argued that, in population biology, increased environmental uncertainty results in optimum strategies which are reflected in a greater niche breadth (higher diversity index) indicates specialization on fewer resources and consequently greater chance of disruption of the food supply, greater success or stability or better adaptation to a particular environment cannot be attributed to an individual or to a group on the basis of a higher numerical value.

It is of interest that there are over 900 wild vertebrate species found within a five-mile radius of St Augustine. Of these, the inhabitants of the three houses studied used 49, (plus eight domesticants and three introduced species) or approximately 5 percent. Although the Maria de la Cruz family used more of these species than did the inhabitants of

ths other no[illegible] were necessarily better adapted to life in St Augu[illegible] other inhabitants Wnat can ba said is that they used more of the available resources, and that consequently their diversity value is more similar to those from Florida aboriginal sites than it is to tha de la Pasqua or Contreras houses

Tha Caribbean site of Nueva Cadiz, which had both aboriginal and Spanish inhabitants, has a noticeably higher diversity value than the Convento site, although concentration on a few selected fish and mammal species lowered the equitability component. Of the Florida aboriginal sites, the highest diversity and equitability came from the San Juan del Puerto mission, suggesting that the mission Indians may have simply added a few Spanish-introduced domestic species to their aboriginal food base instead of substituting. The most interesting aspect of the St. Augustine sites is the comparison between the values derived from MNI and those from biomass calculations. The biomass values are considerably lower, reflecting tha large proportion of domestic meat present in all the sites. The reversal of order of the de la Cruz and Contreras houses in the biomass calculation is a reflection of the greater relative use of domestic mammals (72 to 65 percent) in tha mestizo house, a situation which would not have been predicted at the outset

Diversity and Equitability Measures

Site	No Species	No Individuals	MNI Diversity	MNI Equitability	Biomass (Ed. Mt. Wt.) Diversity	Biomass (Ed. Mt. Wt.) Equitability
CARIBBEAN						
Convento de San Francisco	20	87	2.52	.84		
Nueva Cadiz	36	204	3.15	.88		
FLORIDA ABORIGINAL						
Summer Haven	33	189	3.02	.86		
Goodman Mound	40	150	3.19	.85		
San Juan del Puerto	33	63	3.34	.96		
FLORIDA: ST. AUGUSTINE						
Maria de la Cruz	41	101	3 03	82	1.73	47
Gertrudis de la Pasqua	25	50	2 79	87	1 57	.49
Christoval Contreras	39	154	2 86	.78	1 90	.52

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I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy

Charles H. Fairbanks, Chairman
Professor of Anthropology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

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[redacted], that I have read this study and that in my opinion it conforms [redacted] standards of scholarly presentation and is fully adequate, in [redacted] quality, as a dissertation for the degree of Doctor of Philosophy.

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